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AUGUST 1955

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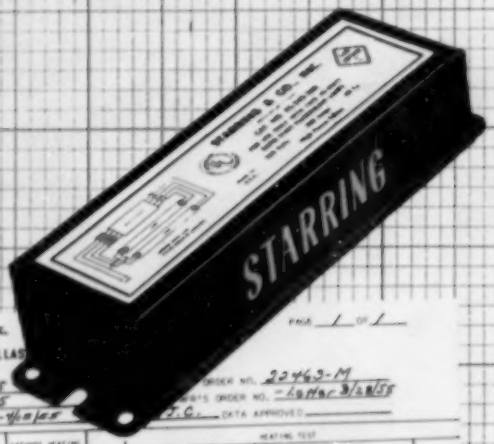

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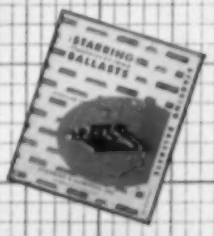

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Founded 1906

ILLUMINATING ENGINEERING SOCIETY

A. D. Hinckley
Executive Secretary

C. L. Crouch
Technical Director

PUBLICATION office 32d Street & Elm Avenue, Baltimore 11, Md.

EDITORIAL and advertising offices 1860 Broadway, New York 23, N. Y.

ILLUMINATING ENGINEERING: The Journal of the Illuminating Engineering Society. Copyright 1955 by the Illuminating Engineering Society. Published monthly in the United States of America. Entered as second-class matter at the Post Office, Baltimore, Md. Acceptance for mailing at special postage rates provided for in Section 1105 P.L.&R., Act of October 3, 1917. Authorized July 16, 1918. ¶ Subscription $12 per year plus extra postage to all countries to which second-class postage rates do not apply; single copies $1.00. ¶ Address changes must be received at I.E.S. headquarters by the first of the month to be effective with the issue of the next succeeding month.

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THE CHALLENGE OF

Churches

Lighting for a church, old or new, is most frequently the lighting engineer's most challenging assignment. Lighting designs for churches exceed, by far, any other single area in the entries to the I.E.S. competition for "My Most Interesting Lighting Job." Three of these entries are described here.

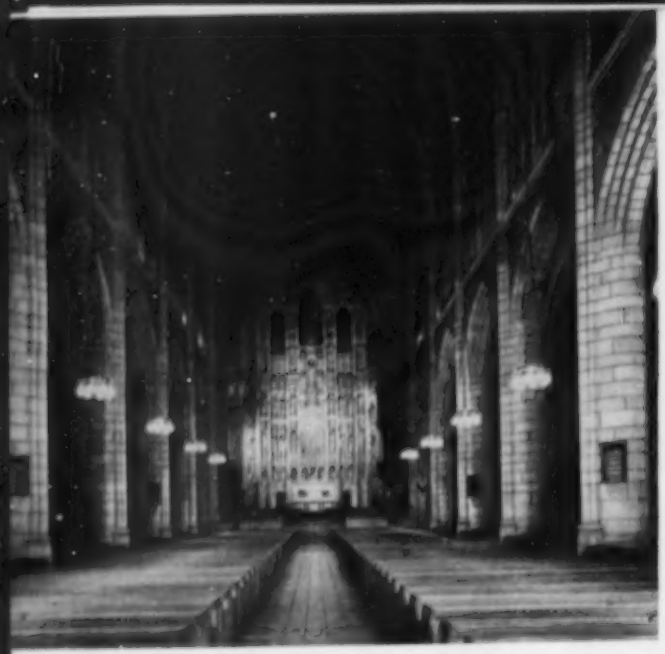
Westlawn Presbyterian Church

A compatible, and comfortable, combination of traditional elements and modern systems has been achieved in this small church in Sioux City. For traditional atmosphere, typical church lanterns have been used in the nave, lamped with 150-watt R40 downlights, louvered, and three 60-watt lamps grouped above, to give luminosity to the glassware and provide upward light to the ceiling. These units alone provide an average illumination of 14 footcandles. For flexibility of effect in various parts of the service, however, the pastor may control, from beside his pulpit, fluorescent cove lighting concealed at the base of the arch, spotlights directed on the pulpit and lectern, recessed eyeball units on the choir and organist, concealed floodlamps projected on the communion table, highlighting the small gold cross.

The cove lighting, from eight-foot slimline standard warm lamps in asymmetric reflectors, lends a restful effect to the interior. Its own five footcandles provides the desired low level of unobtrusive lighting during services, and at the same time offers general upward light which eliminates what might otherwise be excessive brightness of the lanterns during their use.

Louvered spotlights, 150-watt PAR38, are located behind the arch, and directed on the pulpit and lectern within the recommended angle — 50 degrees, with the spotlights crossed to avoid lantern shadows. An additional 15 footcandles is provided with these units. In the chancel, in which is located the choir and organist, recessed eyeball 50-watt PAR38 floodlamps, plus flood and spot lamps are concealed behind the chancel arch. Additional recessed R-30 spots are located in the rear of the chancel and project supplementary light on the communion table. This is an especially pleasing effect, "washing" the rear wall with a relatively high level of light, and quite effectively directing attention to the center of interest — the altar and cross.

Success of the installation, in terms of satisfaction of pastor and congregation, and full co-operation of the architect (Lee Beuttler of Sioux City) and electrical contractor (Keith Lewis) combined to make this the "Most Interesting Installation" of Mark E. Lee, Iowa Public Service Company. The job took first prize in the Cornhusker Section's contest.



St. Thomas Episcopal Church, New York City

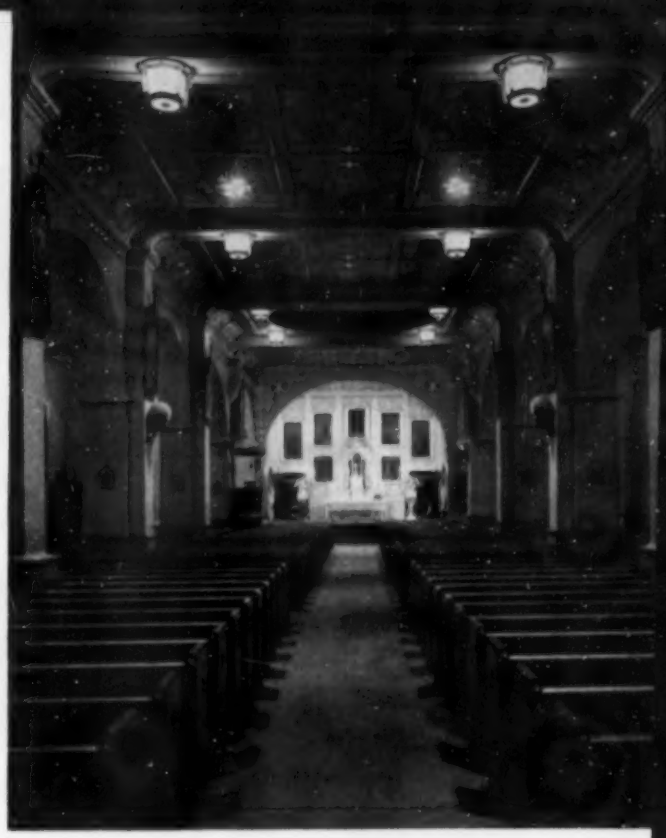
Acknowledged as one of the finest examples of Gothic architecture in New York City, St. Thomas Episcopal Church on Fifth Avenue, was for almost 45 years, only half appreciated. Its magnificent Rose window is unsurpassed; its marble Reredos is one of the tallest and most elaborately sculptured of any in the city. Most of its beauty, however, was unobserved under illumination levels so low that they barely dispelled the darkness.

Without disturbing in any way the English Church atmosphere, and retaining even the same chandeliers, for economic reasons, the illumination was raised from an almost unmeasurable level, to I.E.S. recommended levels for all areas. In the nave area, chandeliers were redesigned to include four concentric ring louvers, and in order to provide space for lamps and sockets, a center drum was built within the upper part of the existing decorative band, the drum perforated with various cut-outs of Gothic design. Within the drum were installed four sockets on swivel attachments to take projector floodlamps. These lamps were directed through the bottom louvers at different angles, with the intent that two would be directed toward the extreme side pews and the other two directed longitudinally along the north and south aisles. An additional socket and lamp within the drum provides general illumination of the fixture. Around the band, eight small stalactite glass globes of light amber color were added each taking a 10-watt lamp. The refurbished chandelier is wired on two circuits. The eight small exterior lights separately controlled provide low level illumination for daytime services. On the second circuit the center downlights are on a dimmer system, and can themselves be controlled as to light output. Principal source of illumination for the center body of the nave is accomplished by installing 500-watt Lekolites in the triforium gallery hidden behind the vertical columns of each arched opening. The choir area is lighted entirely by downlights located in the Triforium, replacing the old chandeliers.

Probably the most effective relighting was for the Reredos, a most impressive example of marble carving, standing 99 feet high from the altar floor. This was lighted by means of ten 500-watt fresnel lens units, five on each side, with color filters graduating the intensity and color from high level at the lower part to a gradual diminishing level and color at the upper part. The altar proper is brought out in sharper contrast by the installation of two spotlights, so focused and shuttered to frame the altar and rectangular Docile directly behind it. The pulpit and lectern are also spotlighted, beamed to illuminate the face of the speaker, and the front part of the pulpit proper.

All lighting design, including the redesign of the chandeliers was the work of Lewis Smith, New York City.

Our Lady Queen of Angels, Los Angeles



If ever a sensitive appreciation of architectural and spiritual values of an interior is needed in illumination, it's in the lighting design of a church. In addition to the intangible needs for enhancement of effect and decorative elements, there is the very practical requirement of light for seeing. In this historic Spanish Colonial building, both of these lighting problems existed, plus a few peculiar to the particular architecture of the church.

A ceiling rich in gold leaf and an ornate interior called for a lighting design to make the most of these beautiful features. A narrow nave section, highly decorative, disinclined the pastor to suspended luminaires. The reading of missals required sufficient light to see them easily, and variations in the service called for such sources to be separate from the general illumination. A requirement of all churches, of course, should be a design which gives the altar visual prominence, making it the focal point of the service.

In the central nave area of this church, a unique surface-mounted shallow downlight was designed to project light in a doughnut shaped distribution, but confined to a cone of 45-degree solid angle. The reflector, gold-tinted for warmth of hue, cross focuses light rays so as to virtually eliminate shadow. Two units per bay each use a 50-watt T-20, inside frost bipost lamp. The efficiency is about 51 per cent for the downlighting portion of the fixture.

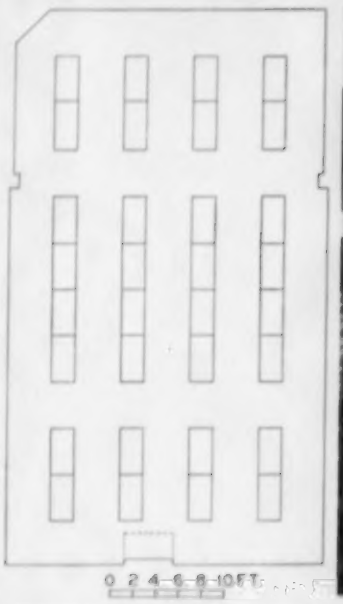
Surrounding this downlight is a hand-tooled carved bronze housing with an ivory tinted, scored plastic diffusing cylinder concealing four 75-watt lamps. This operates on a circuit separate from the downlighting portion of the fixture and provides diffused, pleasing general lighting. At the pew level, there is maintained eleven footcandles, which, combined with an average ceiling brightness of five footlamberts, makes for a beautiful, comfortable interior.

Traditional church lanterns of wrought iron with plastic cylinders were designed to produce a somewhat lower level of illumination in the side aisles. These fixtures are equipped with perforated metal shields which closely fit the 300-watt PS lamps and serve to direct a large portion of the lamp lumens forward, thus relieving the brightness of the side of the cylinder faced by the parishioners.

It was desirable to create a progressive increase of illumination from the rear of the church to the sanctuary as a compelling factor in directing attention forward to the transept and sanctuary areas. Recessed downlights with gold tinted reflectors produce a higher level in the transept section, where 18 footlamberts are maintained. Artistic detail on the proscenium arch is brightened by four 150-watt reflector lamps directed from two columns and producing nine footlamberts.

In the sanctuary, two elliptical downlights with auxiliary reflector plates are used to offset the beam, thus minimizing shadows at the lower section of the altar and brightening the frieze. Two gold-tinted swivel reflectors with 300-watt PS35 lamps are cross-focused from behind the proscenium arch and directed to the altar, while six ceiling recessed adjustable holders using PAR 56 spots and floods further highlight the ornate furnishings and raise the illumination level here to 40 footcandles.

Relighting design was the work of Charles J. Brunner, Department of Water and Power, Los Angeles, and was an entry in Southern California Section's contest for "My Most Interesting Lighting Job."



INSTALLATION AT G. PARKHOUSE AND SONS, 1157 YORK RD., ABINGTON, PA.

Lighting a Grocery Store

LIGHTING OBJECTIVE: To provide quality illumination in a self-service food market.

GENERAL INFORMATION: The sales area is approximately 48'6" long, 27'9" wide with a 9'9" ceiling. Colors and reflectances are as follows:

ceiling	flat white	60% RF
walls	light green	60% RF
floor	green tiles	8% RF
	white tiles	30% RF
counters (top)	light green	40% RF

INSTALLATION: General illumination is provided by thirty-two Day-Brite "Mobilex" catalog no. 44472 units with Alba-Lite glass bottoms, each using four 40-watt deluxe cool white rapid start fluorescent lamps. The units are located in four parallel rows as shown in the drawing above. Illumination after 300 burning hours was 100 footcandles. Brightnesses are indicated below:

fluorescent luminaires	
crosswise at 45°	840 ft-L
crosswise at 30°	260 ft-L
lengthwise at 45°	1600 ft-L
lengthwise at 30°	900 ft-L
ceiling (at 35°)	14.4 ft-L
walls	36 ft-L
floor	24 ft-L
counters (top)	28 ft-L

Lighting designed by William G. Speed, Lighting Engineer, Philadelphia Electric Company; Electrical Contractor: C. W. Frick.

Lighting data submitted by George T. Anderson, Jr., Philadelphia Electric Company, 1015 Chestnut Street, Philadelphia, Pennsylvania, as an illustration of good lighting practice and to aid in the design of similar installations.

Published by the Committee on Publications of the Illuminating Engineering Society, 1860 Broadway, New York 23, N. Y.

Series XX 8-55

A.I.A. File No. 31

The Study of Natural Illumination by Means of Models Under an Artificial Sky

By EDWARD E. VEZEY
BEN H. EVANS

Accurate representation is the key to predicting natural illumination in architecture by means of models under an artificial sky. Highly satisfactory results have been obtained by using modelmaking materials with reflection factors that duplicate those of actual full-scale construction materials involved. It is important that models are constructed in close detail to a scale that is most practical for use with the light measuring cell available.

THE VALIDITY of predetermining illumination by the use of models under an artificial sky was demonstrated by W. C. Randall and A. J. Martin in 1927.[1] Employing an artificial sky consisting of flat sheets of diffusing glass illuminated from the outside, they made predictions for a multi-story building which were found to be in close agreement with the results of measurements made in the building itself. Later work was reported by Gunnar Pleijel[2] of Stockholm who used models under various types of artificial skies and the natural sky as well. By 1947, Pleijel's laboratory had been equipped with an elliptical artificial sky 6.5 meters in diameter which was illuminated by flood lamps placed on the floor.

The first artificial sky used by the Texas Engineering Experiment Station for model studies, started in 1950, was hemispherical in shape and ten feet in diameter.[3] Much useful information on the relationships between building size and shape and natural illumination,[4] and on daylight survey methods[5] was obtained with this equipment. As the work progressed, however, it became clear that if the best possible agreement between full-scale and model tests was to be obtained, the characteristics of the surrounding terrain as well as those of the sky would have to be taken into account. This need for greater flexibility led to the construction of a new and larger artificial sky which is described below. A discussion is given of some of the types of studies which can be made with this laboratory equipment, and of the techniques used.

Artificial Sky

The new artificial sky, shown in Fig. 1, is elliptical in shape, 19 feet in diameter and 7½ feet high. The lower edge is 40 inches from the floor and the space between the floor and sky is covered by a masonite screen which prevents the variable illumination introduced by the laboratory windows and lamps from interfering with the measurements being made under the sky. The surface is formed of 36 segments of 20-gauge black iron bolted together by outwardly projecting flanges from each edge. The bottom circumference is reinforced by an angle iron to which each of the surface segments is bolted, and the whole assembly is supported by four legs welded to the angle iron. The interior is finished in white with texture paint which adheres tightly to the black iron and forms a relatively smooth matte surface having a reflectivity of about 85 per cent.

There are 36 electrical outlets for lamps, adjustable for height and inclination to the vertical, placed in a trough at the lower edge of the sky. The trough is open at the bottom for ventilation and is about 12 inches deep. The inner face of the

Figure 1. New artificial sky.

AUTHORS: Texas Engineering Experiment Station, Texas A. & M. College System, College Station, Texas.

Figure 2. Sky simulating overcast condition.

Figure 3. Sky simulating clear sky condition.

trough is painted gloss white and slopes upward toward the center of the sky at an angle of 45 degrees. Other outlets are provided for lamps that may be placed on the floor beneath the sky or supported on stands as required for the production of various sky conditions. Fig. 2 shows the sky illuminated to simulate an overcast condition, the brightness being about 100 footlamberts at the horizon and 250 footlamberts at the zenith. Similarly, a clear sky condition is shown in Fig. 3, with the brightness at the horizon being about 200 footlamberts and at the zenith approximately 100 footlamberts.[6] Fig. 4 shows how extra light is produced on the terrain to simulate the sun shining on the ground.

With the lamps adjusted to simulate a uniformly bright sky, the illumination on the plane of the horizon is uniform over a circle eight feet in diameter in the center of the sky to within plus or minus one-half per cent. On a vertical plane at the center of the sky the illumination, beginning on the plane of the horizon, increases by about seven per cent in a distance of three feet. While this variation is more than that found on the vertical plane under the actual sky it is satisfactory for the testing of models not more than two feet high. The large circle of uniform illumination on the plane of the horizon makes it feasible to study models six feet by six feet and still give room for the proper representation of the terrain adjacent to the building. As the new sky has no fixed floor on the plane of the horizon, it is possible both to adjust the model vertically so that all parts of the fenestration see approximately one-half hemisphere of sky and to represent properly the terrain adjacent to the building.

Instrumentation

The instruments used in conjunction with the artificial sky for illumination studies are shown in Fig. 5. This picture includes the instrument control panel, the photometer, the wall type galvanometer with reading telescope and scale, and a cell for measuring illumination. The photometer is used for checking the calibration of the various illumination meters and for calibrating the cells used in model studies. The galvanometer is provided with a precision type variable shunt resistance which makes it possible to calibrate the galvanometer to read footcandles in a range suitable for model studies under the artificial sky. The resistance of the galvanometer circuit is low and the linearity factor, for the range of illumination measured, is well above 96 per cent. The cells used for measuring illumination are a commercial brand of high sensitivity provided with filters which made the spectral sensitivity correspond to the standard C.I.E. luminosity curve. The cosine correction devices used are constructed locally and adjusted in the laboratory.

Range of Usefulness

The facilities described above are useful for investigating a variety of problems that arise in the use of natural light. Some of the subjects that may be effectively studied are (1) the comparison of natural illumination for buildings of different size and shape, (2) the effectiveness of sun control devices, (3) the effect of the landscape elements and adjacent buildings on illumination, (4) the prediction of illumination in proposed buildings, and (5) the comparison of daylight survey meth-

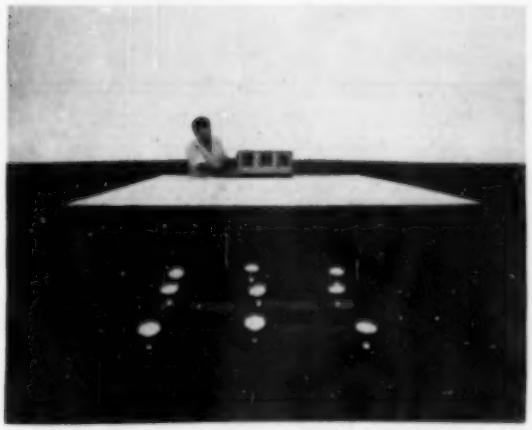


Figure 4. Extra light is produced on the terrain.

Figure 5. Instruments used for illumination studies.

ods. In all of these studies, three factors must be considered: representation of the building, representation of the terrain, and representation of the sky conditions. All of these factors are important and none may be neglected if a high degree of correspondence is desired between model tests and full-scale performance.

Representation of the Building

The model should be built to scale. This applies especially to elements that have to do with the transmission, reflection and scattering of light. The windows must have the same per cent of opening and be glazed with glass or other material having the same transmission factor. The walls, floor, and ceiling reflect and scatter light and should have the same coefficients of reflection as in the full-sized building. The texture of the surface, except for special cases, is not of great importance.

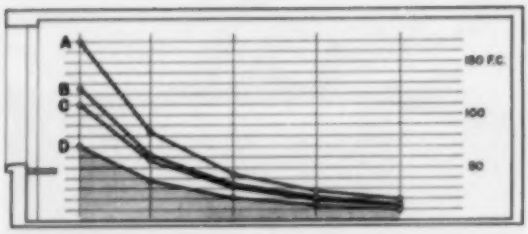
For the production of accurate, sturdy models, hand tools normally are not sufficient. The models should be built with quality power tools which enable the operator to produce square, smooth corners and light-tight joints. Fig. 6 shows the model shop facilities of the Texas Engineering Experiment Station. The making of satisfactory models requires skill and experience. The amount of time required for the construction of a scale model of a room or a building varies, of course, with the complexity of the design, but on the average requires 12 to 16 man-hours.

Plywood is an inexpensive and acceptable material for models and is most often used, but has a tendency to splinter and does not always provide strong joints where nails are hammered into edges. Fiber board can sometimes be used to advantage, usually in conjunction with plywood or some other material which will provide stability. Presswoods are also good materials but their brittleness makes them difficult to work with in many instances. Balsa wood is very useful for window sills and other small details.

Previous research has shown[4] that the reflection factors of interior surfaces have a definite effect on light intensities in a room. It is important, therefore, to provide for proper reflection factors in the models. The ceiling has been shown to be the most important surface, followed in order by the wall opposite the fenestration, the end walls perpendicular to the fenestration and the floor. The last is the least important because intensity readings are usually made on the task, two to three feet above the floor. The reflectivities of wall sur-

Figure 6. Model shop facilities.

Figure 7. Reflection factors measured with reflectometer.



ILLUMINATION CURVES

A - SIMPLE OPENING
B OPENING WITH WINDOW FRAMES
C OPENING WITH WINDOW FRAMES AND GLASS
D - OPENING WITH WINDOW FRAMES, GLASS AND SCREEN

Figure 8. How materials affect light distribution.

faces in the full-scale building are duplicated in models by mixing black and white water paints in proper proportions and applying them to the model. It is a simple matter to mix water paints by the trial and error method to produce any desired reflectivity to within five per cent. Therefore, it does not seem probable that any significant errors are produced in model tests because of inaccurate reflection factors. Reflection factors are measured with a reflectometer as shown in Fig. 7.

Another consideration involved in model tests is the representation of surface materials. Full-scale buildings can be made of many different kinds of materials, such as brick, tile, wood, plaster, wall board and so on. However, it is impractical and in some cases impossible to build scale models using these actual materials. Studies comparing models made of full-scale materials and similar models of plywood, with water paints to duplicate reflection factors, have shown that no appreciable error results from the simplified construction. Concrete block, brick, wood siding, and most other materials can be duplicated satisfactorily by reproducing their reflection factors in the models, but care must be exercised when measuring actual reflection factors to see that joints and other rough surfaces inherent in the materials and methods of construction are included in the measurement. Model tests have also shown that surfaces treated with flat and glossy paints providing the same reflection factor produce substantially the same results.

The duplication in model form of the full-scale fenestration is another important consideration. It has been the practice in the past to use simple openings in models where glazed windows were used in the full-scale building and then apply a reduction factor to the test results to compensate for the effects of glass and mullions. In general this method is satisfactory but for highly accurate results scale windows should be used in the models since they produce a slightly different distribution of intensities than the simple opening. A material that has been found a very excellent substitute for glass in these scale windows is cellulose acetate. Attention should be given to the size and spacing of mullions, columns, and other obstructions. Fig. 8 shows how various materials affect the light distribution within a room. Metal casement windows, represented to scale in models by cardboard cutouts, can reduce intensities inside the model at task height as much as 25 per cent below intensities in the same model with a simple opening. The vertical elements in the fenestration such as window frames, mullions, glass, and wire screen reduce intensities away from the window wall more than at points near it as shown in Fig. 9. On the other hand, as shown in Fig. 10, horizontal elements such as overhangs and louvers reduce intensities near the window wall more than at remote points. Although several attempts have been made to duplicate glass block fenestrations in small-scale models, the results were not satisfactory. Several glass block jointed together in a small model to provide an area proportional to a full-scale glass block fenestration do not produce the same results as far as illumination is concerned.

Previous research[3] has shown that models for natural lighting studies can be constructed to any scale, the major limitations being the size of artificial sky and the size of the light cell used inside the models. However, certain model sizes are better adapted than others to particular conditions.

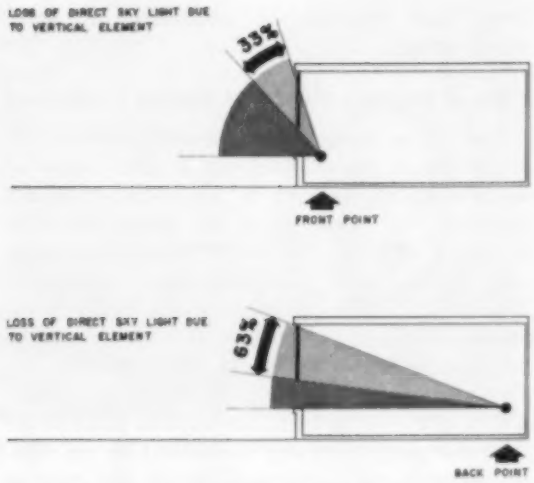

LOSS OF DIRECT SKY LIGHT DUE TO VERTICAL ELEMENT
33%
FRONT POINT
LOSS OF DIRECT SKY LIGHT DUE TO VERTICAL ELEMENT
63%
BACK POINT

Figure 9. How vertical elements affect light intensity.

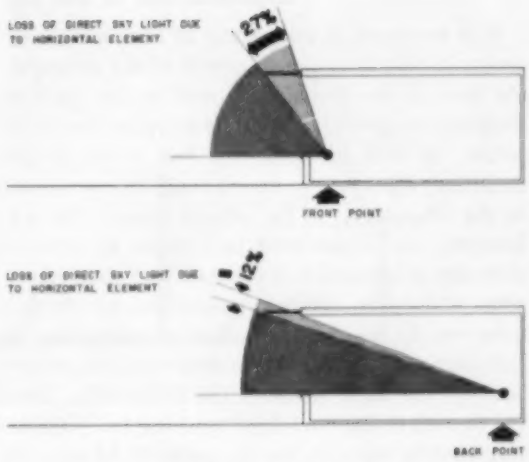

LOSS OF DIRECT SKY LIGHT DUE TO HORIZONTAL ELEMENT
27%
FRONT POINT
LOSS OF DIRECT SKY LIGHT DUE TO HORIZONTAL ELEMENT
12%
BACK POINT

Figure 10. How horizontal elements affect intensity.

Models at the scale of one-half inch to one foot can be satisfactorily tested since there is available a light cell only two and seven-eighths inches in diameter and three-eighths of an inch thick, but in small models with numerous wall projections it is sometimes difficult to place the cell as near the wall as is desirable. Another limitation of the one-half inch scale model is the difficulty of reproducing small but important details. Models built to a scale of three-quarter inch to one foot have proved to be the most convenient for general use. The relative size of the model and the light cell is satisfactory and important details of the building may be readily duplicated. Balsa wood is usually available in pieces which simulate full-scale building materials at the three-quarter inch scale. Models to the scale of one inch to one foot have been used but are usually difficult to handle and require an excessive amount of material. Fig. 11 shows a three-quarter-inch scale model of a 24- by 30-foot room being prepared for testing.

Representation of the Terrain

The terrain is important from the standpoint of illumination by daylight and should be considered as part of the structure. This is especially true when predictions are being made for clear sky conditions, *i.e.*, when there is maximum light on the ground. Experiments have shown that the terrain beyond 100 feet from an isolated single-story structure has little effect on the illumination, so if the proposed terrain is reproduced for that distance, satisfactory results will be obtained. The main consideration is that the ratio of the light reaching the fenestration from the terrain to the total light reaching the fenestration should be the same for both the model and the full-scale building. If one knows the proposed landscaping it is not difficult to determine experimentally what the proportion should be by measurements in similar situations.

If highly accurate results are to be obtained in predetermining natural lighting for a building, the actual finished terrain conditions must be known and duplicated in the model tests. When terrain conditions are known, green grass with a reflectance of only six per cent is usually assumed. This is considered a practical minimum for terrain since it reflects very litle light into the model. Test results will then normally be conservatively predicted as far as terrain is concerned.

Figure 11. Scale model being prepared for testing.

Representation of the Sky

It is necessary in each study of illumination by means of models to choose a type of sky appropriate both to the distribution and to the level of illumination desired. The ideal situation would, of course, be that in which the full range of sky conditions occurring in nature could be reproduced in the laboratory. In the present state of the art, however, one is restricted to a choice of either a clear sky or a completely overcast sky, particularly when the study involves predictions which may subsequently be compared with computations or full-scale measurements. For either type of sky the ratio of the light reaching the fenestration from the terrain to the total light reaching the fenestration must be the same for the model as for the full-scale building for which the prediction is being made. This is especially important with the clear sky, for in this case more light may reach the fenestration from the terrain than from the sky and if careful attention is not given to this relation large errors will result.

For the prediction of illumination for a uniformly overcast sky, a distribution in the artificial sky is used in which the brightness at the zenith is approximately twice that near the horizon. An actual overcast sky is assumed to give an illumination on the vertical plane, independent of the reflection from the ground of 500 footcandles and an illumination of 1250 footcandles on the horizontal plane.

No standard practice has been developed with respect to predictions made on the basis of clear sky, but it is suggested that the proposed landscaping be studied and the ratio mentioned above be established for the model studies by actual field observations on comparable situations. The predictions may then be made on the basis of the illumination reaching the fenestration from the sky only and for a sky typical of the locality involved. Because of the difficulty of simulating sunlight on the fenestration, model studies for clear skies should be limited to north exposures.

The partly cloudy sky has possibilities as a basis for daylight predictions provided the readings of illumination are taken while the surrounding terrain is shaded by a cloud. It has been found by observations that such conditions give a distribution similar to that for a uniformly overcast sky. If by further study the illumination on the vertical and horizontal can be standardized for the partly cloudy sky and become acceptable for use in design, surveys made for the purpose of checking a design would be easier to make because of the relatively high frequency of occurrence of partly cloudy skies.

Use of Daylight Factors in Making Predictions

Since it is impractical to raise the level of the brightness of the artificial sky to give values of illumination on the vertical and horizontal planes equal to those produced by the actual sky, it is necessary by means of proportionality factors to raise the value of brightness and illumination found for the model to values which would obtain under the type of sky for which the study is made. Such proportionality factors, called daylight factors, may be defined as (1) the ratio of the illumination at a given point on the working plane to the illumination from all sources incident on the vertical plane of the fenestration, or (2) the ratio of the illumination at a given point on the working plane to the illumination from the sky only on the vertical plane of the fenestration.

Attention has been called to the importance of having the ratio of the light reaching the fenestration from the sky to the light reaching the fenestration from the terrain the same for the model as for the full-scale building. The reason for this important detail is found in the analysis which follows.

The illumination for any point on the working plane* E_n, is given by

$$E_n = K_g E_g + K_s E_s \qquad (1)$$

where E_g and E_s represent the illumination reaching the plane of the fenestration from the ground and sky respectively, and K_g and K_s represent the ground and sky daylight factors. The factors K_g and K_s are seldom ever equal in value and for most cases K_g is less than K_s. However, since the determination of the actual values of K_g and K_s for any building is difficult, it is more practical to base the prediction upon ratios that can be determined for either the building or the model with equal accuracy. This may be done by defining the daylight factor as the ratio of the illumination on the working plane to the illumination incident on the plane of the fenestration. This factor, K_{E_v}, is given by

$$K_{E_v} = E_n/E_v \qquad (2)$$

where E_n is the illumination at a point on the working plane and E_v is the sum of E_g and E_s. This ratio is easily determined for either the model or the building. The values of K_{E_v} determined for the model will be equal to those for corresponding points in the building provided E_g and E_s of

*The working plane is usually defined as a plane thirty inches above and parallel to the floor.

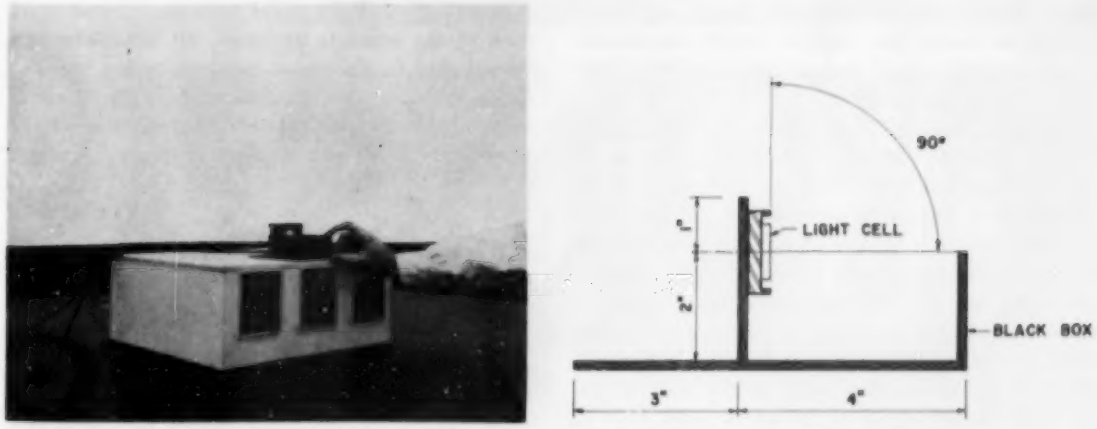


Figure 12. Light cell arranged to measure sky light only, with terrain considered a part of the structure.

equation 1 have the same ratio for the building as for the model. Thus it is seen that careful attention must be given to the preparation of the terrain for the model.

The definition of the daylight factor as given by equation 2 is satisfactory for the predetermination of illumination for any specific situation but may lead to erroneous conclusions when applied to studies made for the purpose of evaluating changes in the landscaping. An increase in the illumination from the terrain will increase the level of illumination at any point in the room, but because of the fact that K_g is less than K_s for most fenestrations, the value of K_{E_s} as defined by equation 2 will decrease with an increase of E_g. If the daylight factor determined under the above conditions for a model is used to predict the illumination for a building under an overcast sky assumed to give an illumination on the vertical face of the fenestration of 500 footcandles from the sky only, the computed values of E_n will be too small. The correct procedure would be to add to the 500 footcandles an amount equal to 500 (E_g/E_s), thus raising the value assumed for the sky only to one corresponding to the illumination reaching the fenestration from both the sky and the terrain. To avoid the necessity of increasing the assumed illumination from the sky, it has been suggested[8] that the daylight factor be defined as the ratio of the illumination at a point in the working plane to the illumination incident on the fenestration from the sky only,

$$K_{E_s} = E_n/E_s \qquad (3)$$

This definition is more useful for the predetermination of illumination by means of models since it considers the terrain to be a part of the structure and gives daylight factors which increase for all values of E_g regardless of the value of K_g relative to K_s. If two or more surveys made for a given type of fenestration for widely different conditions of terrain and sky are expressed in terms of daylight factors, the deviation from the mean value will be smaller when the factors are defined by equation 2 than by equation 3 since the former has the larger denominator.

Testing Methods

The common method of testing buildings for natural lighting, as described previously, is to measure interior intensities simultaneously with an exterior intensity, the latter serving as a basis for comparison. It has been the general practice to take the exterior reading in a vertical plane at the outside edge of any overhang or obstruction and about at the center of the height of the fenestration. With this arrangement the light falling on the cell is that from one-half of the sky plus that reflected by the terrain $(E_n = K_s E_s + K_g E_g)$. This exterior reading then can be adjusted to a common base for comparison with other tests and the interior readings increased or decreased proportionally. The common basis generally assumed for the exterior intensity is 500 footcandles, usually considered a minimum condition for design purposes. The exterior reading in a model test using this method must be made at the same relative location as for the full-scale building.

If the basis for comparison is to be the light from the sky only[6] $(E_n = K_s E_s)$, so that the terrain is to be considered a part of the structure, the light cell can be arranged as shown in Figs. 12a and 12b. For exterior readings (E_s) on full-scale buildings where the distance to the horizon is infinite, the cell may be placed in any convenient position for reading the sky intensity. For exterior readings in

model tests, this cell can be placed anywhere around the model from eight to twenty-four inches above the ground level and within three feet of the center of the artificial sky.

The light measurements inside the model must also be taken in the same relative location as in the full-scale building. This can be done easily if a number of light cells are available so that they may be accurately placed at each desired location before the testing actually begins. However, if only one light cell is to be used (and this eliminates many calibration problems) a convenient way to relocate the cell accurately after each single reading is to provide a small nail in the floor of the model at the desired location and a small hole in the cell holder.

Frequently during model tests under the artificial sky the intensity of the incandescent lamps fluctuates slightly even though a voltage regulator is used. To determine when these fluctuations occur and thus avoid irregularities in test results, a reference light cell is placed in some convenient location under the artificial sky. By keeping a constant check on the intensity of the sky in this way, illumination fluctuations can be easily detected.

During model and full-scale tests it is sometimes necessary to render certain openings in a building opaque so that all light reaching the inside of the building can be referred to a common base. By making all openings opaque except the one under consideration, the effect of the light from only one direction can be measured. After the intensities at points in the building have been determined from each of the separate openings, all intensities can be adjusted to a common base and added together for comparison with other data. It has been determined experimentally that this procedure can be used in model tests with a high degree of accuracy.

Conclusion

Equipment and methods suited to the study of a number of currently important problems involving the utilization of natural light have been described. It is expected that improved laboratory facilities and techniques to keep pace with the state of the art will follow as new design methods are developed and testing procedures become standardized.

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INSTALLATION IN TULSA, OKLAHOMA.

Luminous Soffit Lighting in a Kitchen

LIGHTING OBJECTIVE: To provide recommended levels of lighting with emphasis on the attractive appearance of the room and the comfort and convenience of the homemaker, and to create with light an atmosphere cool in summer and warm in winter.

GENERAL INFORMATION: This kitchen is 11 feet x 14 feet 6 inches, with a 5-foot x 11-foot storage and laundry area at one end. The ceiling, which is of eggshell acoustical tile, is 8 feet high. All cabinets, refrigerator and counter tops are light green (60 per cent reflectance). The floor is yellow (45 per cent reflectance). The wall space above counter tops is of walnut paneling (about 15 per cent reflectance).

The long axis of the kitchen faces south, and the only daylight in the room comes through a heat-absorbing 15-inch x 120-inch green glass panel under the cabinets on the south wall, and a double hung 18-inch x 18-inch window to the west. To the south it is 200 feet to a building, and the intervening space has shade trees to give protection from the morning sun. Shade trees also provide west shielding from the afternoon sun for that small window. The entire house is air-conditioned.

INSTALLATION: In the soffit above all wall cabinets two rows of 425 ma cold cathode tubing (one row of cool and one row of warm white) are installed as shown in Fig. 3. Thirty-three feet of each type are used. Flashed opal glass is used for the soffit closure. The cool white lamps are used in summer, and warm white in winter to give the illusions of coolness and warmth.

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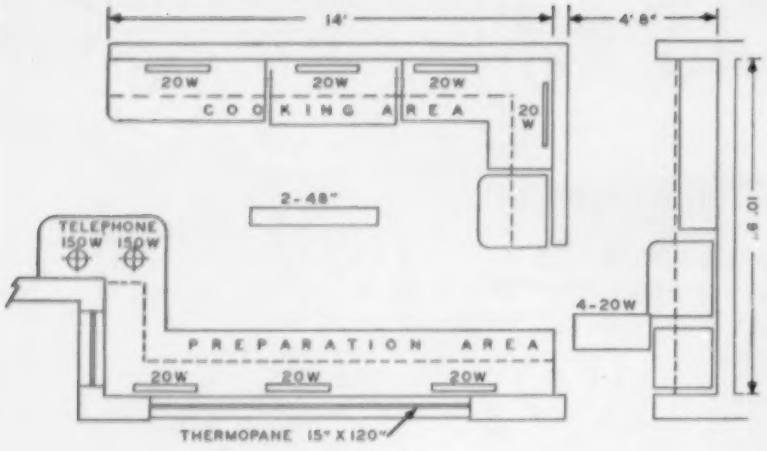

Figure 2. Plan view

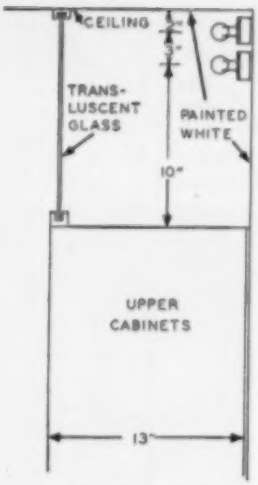

Figure 3. Cross section of soffit

Seven 20-watt deluxe cool white hot cathode fluorescent under-cabinet light units (Alkco No. 320) with Alba-Lite glass diffusers are installed at locations shown in Fig. 2. Recessed in the center of the kitchen ceiling is a unit with diffusing glass bottom (Ruby-Philite) and two 48-inch T-12 standard warm white slimline fluorescent lamps. A four 20-watt fluorescent unit (Sylvania No. R423) is placed almost directly over the washer and freezer in the storage area. Completing the installation is a pair of recessed 150-watt reflector spot lamps (Rubylite No. L4056) over the telephone-order center.

Illumination measurements are as follows:

	Overhead & Under Cabinet Units Only	Overhead, Under Cabinet & One Circuit of Soffit
Preparation Area		
Center of Range	27 ft-c	39 ft-c
Counter Tops in Preparation Area	47 ft-c	57 ft-c
In Sink	33 ft-c	56 ft-c
Cooking Area		
Center of Range	27 ft-c	39 ft-c
Storage Area		
Counter Tops	21 ft-c	27 ft-c
Inside Cabinets — on packages (vertical)	7-10 ft-c	
Entire Room		
(Readings taken on 30-inch horizontal plane in center of each quarter of room, and averaged)		
With Deluxe Cool Lamps in Soffit		47 ft-c
With Deluxe Warm Lamps in Soffit		46 ft-c
Telephone Area		
With Both Recessed Spots in Use		105 ft-c

Room brightnesses with all lighting on (but only one circuit in soffit) are:

Soffit Average	190 ft-L (at 45° from horizontal)*
Center Fixture	1100 ft-L (at 75° from horizontal)*
Ceiling Average	24 ft-L
Cabinets Closed	12 ft-L
Floor	15 ft-L

*From no work position are these brightnesses in the field of view or immediate surround.

Lighting data submitted by Dale H. Watt, Watt Plumbing, Heating and Air-Conditioning, Tulsa, and W. T. Walters, Public Service of Oklahoma, Tulsa, as one solution to a lighting problem and to aid in the design of similar installations.

Published by the Committee on Publications of the Illuminating Engineering Society, 1860 Broadway, New York 23, N. Y.

Contemporary Lighting System for a Century-Old

milj Traditional Interior

By ERNEST STOHLMANN

PROVISION of sufficient light for a room's use, comfortably distributed within its space, is the major objective of almost every installation on which a lighting engineer consults. For this "relighting" job, an old historic Court House, an indefinable factor added greatly to its interest. When I say "relighted," I mean that the "before" condition was the same as when the Dred Scott case was heard in this same building, in 1847. The room shown is newer than this — it was first lighted in 1854.

The early splendor of this old Court House in St. Louis, Missouri, had long been lost — a great pity. At the time of its construction (1839*) the old Court House was without doubt one of the finest public buildings in the west. Hand-carved wooden columns of Greek-revival design lend an elegant grace to the room. Floors are of white marble. In the renovation, a Federal project undertaken by the National Park Service, the seven Circuit Courtrooms in the building are being restored as closely as possible to their traditional beauty. The walls have been painted a deep burgundy; carved walnut furnishings carry out the room's rich tradition.

Quite wisely, the relighting of this old building has not been designed as a slavish replica of the gas lighting which dimly dispelled the darkness in 1854. Instead, contemporary systems have been used to still further enhance the splendor of the early architectural elements. Mainstay of the original lighting was an oval dome recessed in the ceiling, with skylight, through which light was furnished during the daylight hours. It still is, but fluorescent lighting within the dome extends its usefulness, and enhances the restored paintings on the walls of the skylight dome.

For general lighting, preservation of the original architectural design was of first importance, with no distractions desired. A natural cove around the entire perimeter of the room was also a "natural" for cove lighting with a continuous row of fluorescent lamps. A double row in a staggered arrangement would have been better, and was included in the first layout, since some shadow is evident at the juncture of the lamps. Overall, however, the effect brings to life the restored elegance of the interior.

*The construction and laying of the corner stone began on October 21, 1839 and was completed in the 1850's.

Architect directing renovation is John Albury Bryan.

AUTHOR: Lighting Specialist, Union Electric Company, St. Louis, Mo.

A New Searchlight Carbon Arc Lamp

By J. P. LATIL

TO MANY Illuminating Engineers it may seem odd to describe a *new* carbon arc lamp described in a paper written in 1955, since the use of these lamps has long been forgotten by the public and by most illuminating engineers. However, such lamps are still required when a source of light of great brightness is necessary, for instance in theatre projection lamps, arena spotlights, and civilian or military searchlights.

The carbon arc lamp described was designed to fulfill a particular specification:

> "The searchlight has a diameter of 18 inches. Energy available at the arc lamp is 1200 watts of alternating current. The beam must have a wide horizontal divergence and a one-inch vertical divergence. The peak beam candlepower must be 10 million candles minimum. During the night the searchilght is not accessible to the operator for adjustment or repairs. Operation is by remote control. The searchlight must operate for eight hours minimum and automatically, with a one-minute interruption maximum every hour for automatic recarboning."

The new arc lamp described, designed to these specifications, has the following main features:

(a) It operates on any alternating current (50, 60, or 400 cycles.

(b) The source of light has the shape of an ellipse with a long horizontal axis, suitable for a widely diverging beam.

(c) Its operation is entirely automatic *and* simple.

General Characteristics

The axes of the two identical carbons are in an horizontal plane and make an angle of 24° (Fig. 1b). Tests made with parallel carbons (Fig. 1a) showed that operation was not stable. The arc moved up from *A* to *B* when the current was too high. But to the contrary, with a 24° angle or more the arc remains steadily in *A* at the tip of the carbons.

Fig. 2 shows the arc lamp in operation in front of a reflector. The bright tips of *both* carbons are directed toward the reflector.

The brightness of the tips is only half of the brightness of the positive carbon crater of a direct current arc lamp of the same power. But the area of the source of light is two times greater and its shape (Fig. 2, front view) is very suitable for an horizontally diverging beam searchlight.

When the gap between the carbons is one-eighth-inch to one-quarter-inch, the brightness of the flame between the carbons is lower than the carbons and the beam candlepower distribution shows a "camelback" (Fig. 3).

To avoid this camelback the gap between the carbons is reduced to one-thirty-second inch (Fig. 4 top view). When the source of light is looked at from the front (Fig. 4 front view), a thin dark line between the carbons can barely be seen. The beam candlepower has the satisfactory distribution shown on Fig. 4.

Arc Control — With a gap of one-sixty-fourth inch between the carbons, the arc voltage is 20 volts. If the arc operates while the carbons are *not* fed, the gap increases slowly to one-thirty-second inch while the arc voltage reaches 21 volts. A relay then is tripped and a motor feeds the two carbons (Fig. 1b) to reduce the gap to one-sixty-fourth inch and the voltage to 20 volts. Thus, the feeding is intermittent. The motor operates every 15 seconds for two or three seconds. In the meantime there is no moving part in the arc lamp.

As the two carbons are fed simultaneously and equally the focusing of the lamp in the searchlight is assured *geometrically* by the operation of a voltage differential relay.

Striking the Arc — An original method for striking the arc has been devised. When the current is turned on, there is a short gap between the carbons (Fig. 5-1). The feed motor brings the carbons in contact (Fig. 5-2). As soon as the carbons touch each other the motor stops. The contact point becomes red, ignites and volatilizes (Fig. 5-3). This creates a gap and strikes the arc. The gap increases until it reaches one-thirty-second inch (Fig. 5-4). Then the arc control starts to operate. (The motor does not pull the carbons away after striking: the carbons "burn" their gap themselves!)

A paper presented at the I.E.S. Searchlight Committee Meeting in Fort Belvoir, Virginia on January 20, 1955. The author is the President of Genarco, Inc. of Jamaica, N. Y.

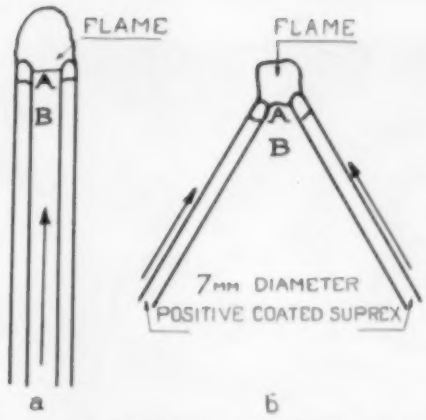

Figure 1. Operation of an a-c arc between two parallel carbons at an angle. a — when carbons are parallel, operation is not stable. Flame moves between A and B. b — with carbons at an angle operation is stable. Arc does not move to B. Arrows show the direction of "feeding of the carbons."

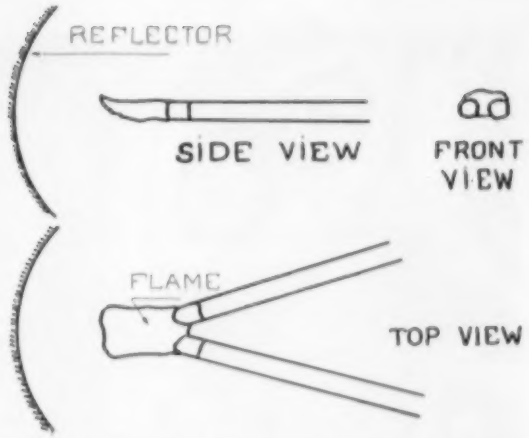

Figure 2. Operation of the arc lamp in front of a reflector. The bright tips of both carbons are directed toward the reflector. There is no primary shadowing.

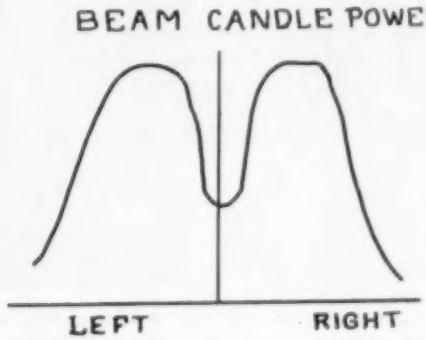

Figure 3. Horizontal candlepower distribution of the a-c 1 arc lamp placed in front of a parabolic reflector. When the gap between the carbons is ⅛ to ¼ inch, the distribution is not satisfactory.

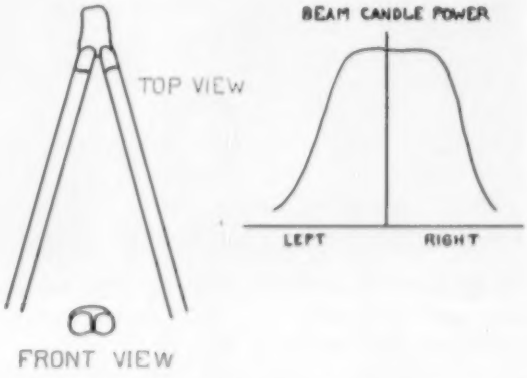

Figure 4. Operation of the arc lamp with a very short gap between the carbons. When seen from the front, the source of light has the shape of an ellipse. The horizontal candlepower distribution is very satisfactory.

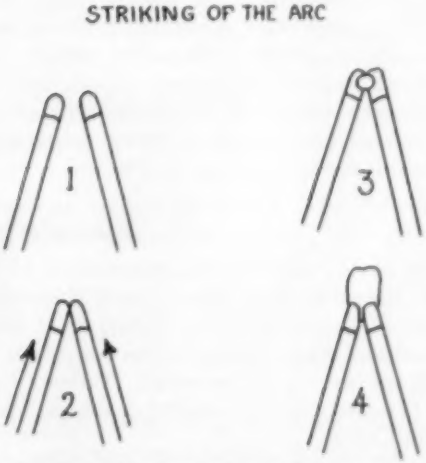

Figure 5. The original method of striking the arc. The carbons are moved slowly together until they contact. Feeding motor stops and the arc "burns" the gap itself.

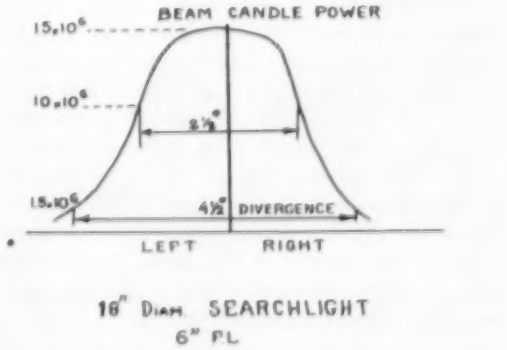

Figure 6. Horizontal beam candlepower distribution of arc lamp a-c 1.

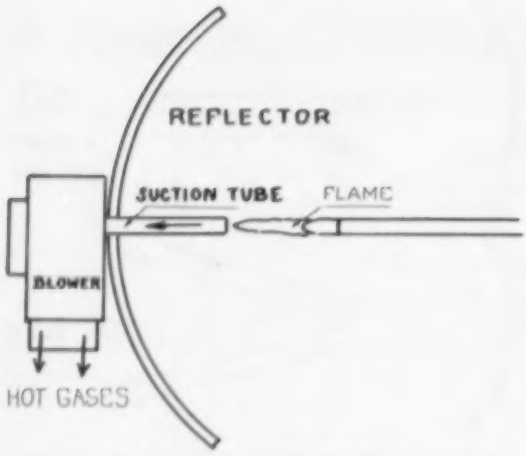

Figure 7. Smoke and hot gases are removed through the reflector center.

Characteristics of the Arc Lamp
Carbons: 7mm diameter, positive coated Suprex
Angle between carbons: 24°
Voltage: 20 to 21 volts a-c
Current: 60 to 58 amperes
Brightness: 250 candles/mm²
Consumption of either carbon: 4" per hour

Beam Candlepower Distribution in the 18-Inch Diameter Searchlight — Fig. 6 shows the horizontal beam candlepower distribution. Peak is 15 millions. Candlepower is over 10 millions in a 2½° angle and over 1.5 million in a 4½° angle. Vertical divergence (not shown) is 2¼°.

Cooling of the Searchlight and Smoke Removal— Smoke and hot gases are sucked by a blower through the center of the reflector (Fig. 7). The searchlight drum is kept cold and the reflector clean.

Automatic Recarboning of the Lamp — With 10-inch carbons the lamp can operate for two hours without recarboning. A mechanism has been made to assure an automatic recarboning. Ten minutes before the two original carbons are consumed a red pilot light lights up on a panel board. The searchlight operator has an option to press a recarboning button. If he presses it, the light turns itself off, the two carbon studs are removed and replaced by two new carbons in the lamp, the arc is struck. The whole operation takes less than 30 seconds. Details are shown on Fig. 8.

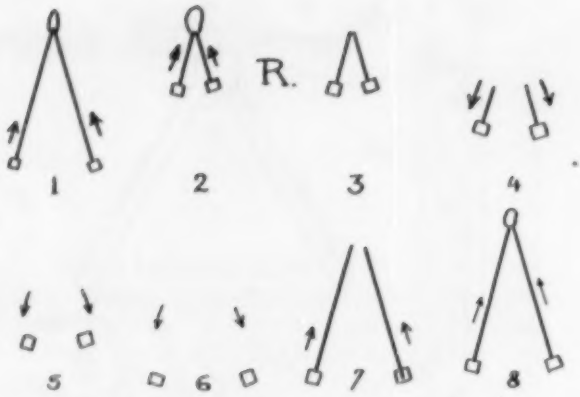

Figure 8. Principle of the automatic recarboning.

1. The lamp is in operation. The arrows show the direction of feeding. The two squares are the carriages that push the carbons toward the arc.
2. The lamp is still in operation. The carbons are getting very short.
R. The operator presses the "Recarboning" button. From now on all the operations are automatic.
3. The current is turned off. The arc is "off."
4. The carriages move backward at fast speed (as shown by the arrows).
5. The carriages still move backward and they have rejected the two carbon stubs.
6. The carriages still move backward until they pick up two new carbons in the magazines.
7. They now start to move forward at high speed. When the carbons are near the contact, the carriages move very slowly until the contact is made.
8. The carriages stop. The arc is struck. The whole operation since the time the recarboning button was pressed has taken less than 30 seconds.

If the operator does not use his option, the recarboning takes place automatically at the end of two hours of operation. Therefore, without attendance and with the magazines and the lamp fully loaded with five trims of carbons, the arc lamp operates without attendance for 10 hours with 30 seconds interruption every two hours.

Acknowledgments

The author expresses his appreciation to Engineer Research and Development Laboratories, Corps of Engineers, U. S. Army, Fort Belvoir, Va. without whose assistance this searchlight lamp could not have been developed. National Carbon and Lorraine Carbons supplied sample carbons and useful advice.

INSTALLATION AT WILF BROTHERS, 6577 ROOSEVELT BOULEVARD, PHILADELPHIA, PENNSYLVANIA.

Lighting a Floor Coverings Store

LIGHTING OBJECTIVE: To provide general illumination and highlight merchandise in a long and narrow store.

GENERAL INFORMATION: This store displays all types of floor coverings. The first floor measures approximately 146 by 19½ feet; ceiling height is 12 feet. Colors and reflectances are as follows:

ceiling	white	85% RF
walls	light gray	60% RF
floor	light mottled gray	30% RF

INSTALLATION: General illumination is provided by thirty Keystone No. H486-4 luminaires, each using four 96-inch T-12 deluxe cool white slimline fluorescent lamps operated at 430 ma. Accent lighting is provided by twenty-six Keystone No. SP-20 adjustable spots, each using a 150-watt PAR-38 spot lamp, located in the parallel lines of slimline units as shown in Fig. 2. Illumination

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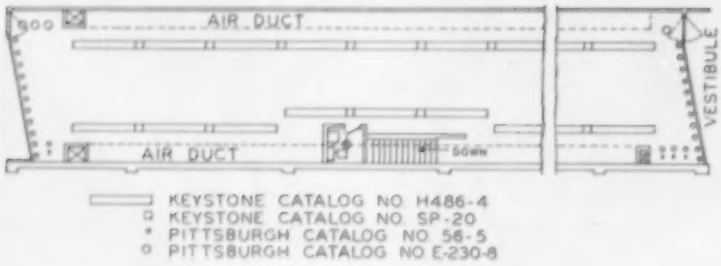

Figure 2. Plan view.

in the two show windows is provided by twenty-six Pittsburgh No. 56-5 window reflector units and four Pittsburgh No. E-230-8 downlights. After 200 burning hours the illumination was as follows:

	Between Spots	Under Spots
floor displays	120 ft-c	140 ft-c
bottom carpet roll (18" from floor)	120 ft-c	140 ft-c
second carpet roll	110 ft-c	160 ft-c
third carpet roll	110 ft-c	160 ft-c

Brightness distribution is indicated below:

fluorescent luminaires	
crosswise at 45°	1700 ft-L
crosswise at 35°	1100 ft-L
crosswise at 20°	1100 ft-L
lengthwise at 45°	1900 ft-L
lengthwise at 30°	1200 ft-L
lengthwise at 20°	860 ft-L
ceiling (between rows of luminaires)	33 ft-L
walls	66 ft-L
floor	39 ft-L

Lighting designed by George T. Anderson, Jr., Lighting Engineer, Philadelphia Electric Co., Philadelphia, Pa.

Lighting data submitted by George T. Anderson, Jr., Philadelphia Electric Co., 1015 Chestnut Street, Philadelphia, Pa., as an illustration of good lighting practice and to aid in the design of similar installations.

Published by the Committee on Publications of the Illuminating Engineering Society, 1860 Broadway, New York 23, N. Y.

Lighting Items On the Menu

Atmosphere has an important effect on digestion—and the best food tastes even better when eaten in pleasant surroundings. Smart restaurant managers use lighting to enhance the appeal of a rare steak and a crepe Suzette.

Walker's Restaurant, Napa, California

The owners of this restaurant wanted a lighting system which would not only compliment its architectural features, but which would also fit into its flexibility. The room is designed so that it may be used as one big banquet room, or separated, with folding doors, into two or three smaller dining rooms.

To give a feeling of continuity in design when the area is used as one room, three luminous panels were installed. Two of them measure 12 feet by 24 feet and the third is 12 feet by 20 feet. The smaller panel is illuminated with 100-watt incandescent lamps in porcelain sockets on 3-foot centers, controlled with a dimmer. The other two panels use T12, 430-ma slimline lamps on 2-foot centers, with alternate lamps switched separately. This arrangement yields an average of 10 footcandles under the smaller panel when area is divided, and 25 footcandles on table-tops when the whole area is used as a banquet room.

To accent the architectural features and add to the flexibility of the lighting, 100-watt incandescent spot units are recessed in the ceiling at various location, and ornamental brackets are mounted along the walls.

This installation was the entry of Norman Schiewe, Pacific Gas & Electric Co., San Rafael, Calif., in the Golden Gate Section's contest for My Most Interesting Lighting Job. Electrical contractor was Valley Electrical Service.

CRYSTAL ROOM

Patricia Murphy's Candlelight Restaurant,

Newest in the series of Candlelight Restaurants has been opened by Patricia Murphy in Yonker, N. Y. Occupying a long, rambling building on an artificial lake, the restaurant aims for a French-flavored New Orleans atmosphere.

Three dining rooms and the cocktail lounge provide service capacity for 800, each area having its own distinctive decorative and lighting treatment. Foliage plants and flowers are used extensively as a common denominator and the lighted plants are a feature of the decor.

Crystal Room — The main dining room is the Crystal Room where crystal chandeliers of an ornate Italian design are suspended from the red

GARDEN ROOM

Photos and data on the Candlelight Restaurant are courtesy of *The Magazine of Light*, General Electric Co., Lamp Division, Cleveland, Ohio.

GOLD ROOM

Yonkers, New York

and white striped velvet canopy-type ceiling. The chandeliers and the crystal wall sconces are internally lighted with clusters of small tubular incandescent lamps. Cove lighting along the sides of the room and recessed downlights on Oriental shrubs supply the finishing touches.

Garden Room — Here a cove effect is obtained by projecting light and plant boxes out from the lower ceiling. Light boxes use two 100-watt and two 25-watt incandescent lamps. On the columns plant holders have 150-watt PAR-38 lamps for upward light and 100-watt lamps for downlight. Green tree wallpaper with cream background adds to the garden atmosphere. Ceiling is yellow, floor is of black and white tile.

Gold Room — A monochromatic color scheme of gold is lighted to advantage by architectural coves using about 325 15-watt incandescent lamps on 6-inch centers. A series of large leaf and flower chandeliers, also painted in gold, house 150-watt and 60-watt silvered bowl lamps — 150-watt for indirect and 60-watt for direct lighting. Recessed downlights in the lower ceiling along the sides of the room supply 35 footcandles along the window row and on plant boxes.

Cocktail lounge — The flowering room divider, which separates the cocktail lounge from the reception area, is highlighted by recessed units using 75-watt R-30 lamps, mounted on 4-foot centers. Similar units are mounted over the bar. The bar itself, which like the chairs is upholstered in sealskin, is lighted by a strip of 15-watt incandescent lamps on 12-inch centers just under the edge.

COCKTAIL LOUNGE

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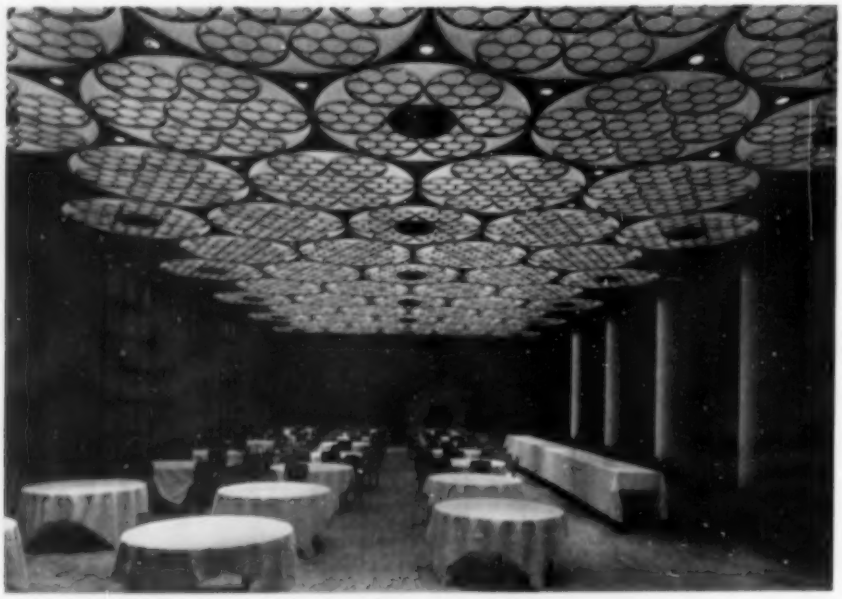
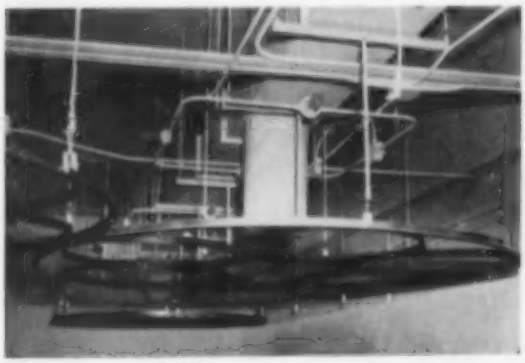


Terrace Room, Fairmont Hotel, San Francisco, California

The entire atmosphere of the Terrace Room was designed around the lighting. For aesthetic reasons the architect chose the form of the circular pattern as the theme of the room, which is used for banquets, formal weddings, and many other purposes.

The basic module was set by the diameter of the air-conditioning diffuser, 32-inches. Seven circles of this size are placed in each large circle of 8-foot diameter, and each in turn is subdivided with seven smaller circles of approximately 11 inches diameter. Area between the largest circles is acoustical tile.



Circle arrangement

The areas occupied by the circles constitute luminous panels of translucent plastic.

Mounted 18 inches above the plastic and 18 inches below the true ceiling, a total of 420 100-watt A-21 incandescent lamps are on conduit. The entire plenum chamber is treated with a high-reflectance white paint. Throughout the ceiling 150-watt PAR-38 lamps are mounted in the acoustical tile section.

To complete the circular design of the ceiling, one wall has been buttressed to fit the perimeter of the circles, and is covered with burlap-type plain wall covering. Behind the buttressed walls cove lighting is from 25-watt A-19 incandescent lamps mounted on conduit on 6-inch vertical spacing. These are on dimmer control, as are the lamps above the translucent plastic panels.

Measured illumination levels are: with luminous panels only, 23 footcandles; luminous panels and spots, 75 footcandles. Brightnesses are:

Floor, 38% RF — average	10	ft-L
under spots	23	ft-L
Luminous panels	35	ft-L
Acoustical tile, black, 5% RF	0.5	ft-L
Table cloth — average	29	ft-L
under spots	41	ft-L
Walls, 25% RF	25	ft-L
Vertical wall cove — concave	2.5	ft-L
convex	4.0	ft-L
cove	16	ft-L

Acoustical treatment and air-conditioning are built into the ceiling system. Diaphragmatic dampening of the plastic panels is supplemented by the acoustical tile sections, and the burlap wall. The air-conditioning ducts are carried above the luminous ceiling.

This installation won second prize in the Golden Gate Section's contest for My Most Interesting Lighting Job, for Willard A. Marks of the Daylight Ceiling Co., San Francisco. Architect was Mario Gaidano; Ceiling Contractor, F. K. Pinney, Inc.

El Cortez Hotel Ballroom, San Diego, California

The lighting system for a spacious ballroom, where activities include eating, dancing and just relaxing with a tall cold drink, should provide something of a festive appearance in addition to its functional qualities. In the El Cortez Hotel Ballroom, a dark coral dome in the 19-foot-high ceiling over the dance floor is illuminated by cove lighting from fluorescent lamps and a six-foot pin-cushion type unit using forty 25-watt round white lamps, on dimmers, suspended from the center. Another highlight is the 40 feet of lighting, also on dimmers, on the mural.

Additional illumination in the main body of the room, which is 80 by 100 feet in area, is from 26 150-watt recessed units and 18 150-watt pinpoint spots in alternate rows. With all the ceiling fixtures on, the illumination is 10 footcandles; using only the pinpoint spots, about 5 footcandles.

At the bar end of the ballroom, the ceiling is dropped to about eight feet, and ten 150-watt units are recessed in it. Over the bar stools nine pinpoint fixtures follow the curve of the bar, and a mural behind the bar is lighted by six 75-watt adjustable recessed units.

A level of 40 footcandles can be obtained on the stage from the six 150-watt adjustable recessed units behind the curtain and the six in front of the curtain, supplemented by seven such units, with louvers, located in the wall created by the dropped ceiling.

Walls and ceiling are a dark slate green, the dome is dark coral and the murals are gold.

This was the entry of S. A. Furniss, Coast Electric Co., San Diego, in the San Diego Chapter's contest for My Most Interesting Lighting Job, winning first prize in the Chapter and third at the South Pacific Coast Regional. Architect for the ballroom is Richard George Wheeler.

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Dutch Mill Farms, Annapolis, Maryland

Glass panel separating kitchen from dining area is at left, allowing customers to inspect kitchen by turn of the head.

Part of the appeal of this quaint odd-shaped restaurant (it is an octagon with one point smoothed off) is its atmosphere of home dining. This appeal is pointed up in the dining area by the colonial-type frosted chimney fixtures, using five 40-watt incandescent lamps, each. Over the counter dining space, where the ceiling is a foot or so lower, twenty recessed 150-watt PAR floodlamps have color lenses giving a rainbow effect, and also 15 footcandles illumination.

The kitchen at the Dutch Mill Farms is a large showcase, being separated from the dining area by a glass partition. Here eight troffers with curved Alba-Lite lenses provide 40 footcandles maintained to show off the spick and span cleanliness.

Fresh produce is prepared for cooking in a section of the basement, where washing operations are conducted under 2-lamp 40-watt industrial-type fixtures with 45° by 45° shielding. Measured illumination over the washing tables is 50 footcandles maintained.

Other areas in the basement are used for storage and are lighted to 10 footcandles with fourteen 150-watt RLM reflectors.

This installation won third prize, for Robert L. McCalley, Sylvania Electric Products, Inc., in the Maryland Section's contest for My Most Interesting Lighting Job.

Color and the Illuminating Engineer

Prepared by the Committee on Color and Illumination of the Illuminating Engineering Society

Preface

Color for a given project is a design problem and is primarily the function of an architect, designer, color consultant or decorator. However, in practice it is often the illuminating engineer who is called upon to make recommendations with regard to color. The assignment of the Color and Illumination Committee is to study, and report on the effect of color in relation to the art and science of illumination as a guide to the illuminating engineer in the use of color. We have undertaken only to outline the scope of the illuminating engineer's responsibility and to call attention to some of the basic principles relating to the effect of color on vision. It is the intention of this committee, as a further objective, to prepare a manual on the use of color for the lighting engineer giving more specific and detailed information on the selection of colors and color combinations on lighting projects.

The committee submits herewith an interim report setting forth significant aspects of the problem.

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1. Scope of the Illuminating Engineer

The illuminating engineer should consider and play an important role in the choice of color in the following categories particularly where the areas under consideration are critical seeing zones, such as schools, offices, industrial plants, and where color rendition or matching is important.

1.1—*Color of the Illuminant* — The color of the light source is a prime responsibility of the illuminating engineer. Since the appearance of an object or the surround is dependent upon the color of the light source, it is believed that the illuminating engineer is the natural consultant in this regard. (The Subcommittee on Color Rendition is currently studying this problem.)

1.2—*Reflectance of Task and Surround* — The reflectance values of the task and surround are within the scope of the illuminating engineer because they affect the quantity and quality of lighting. The quantity of light is dependent upon the utilization factor of a room, which is determined in part by the light reflecting value of ceilings, walls, floors and equipment. The reflectances of these areas, therefore become a responsibility of the illuminating engineer. The quality of lighting is dependent upon the brightness of the task and surrounding areas and the brightness relationships among them. Excessive brightness ratios and brightness differences cause glare and undue eyestrain. Reflectance values provide one means of quality control, thereby becoming a responsibility of the illuminating engineer.

1.3—*Color and Perception* — The effect of color on perception or ability to see is the responsibility of the illuminating engineer, because color is one of the factors in seeing. The influence of color may be physiological or psychological. Where the seeing task consists of accurate color discrimination surrounding colors become particularly important. Their choice is therefore a function of the illuminating engineer.

1.4—*Color and Decoration* — Color for purely decorative or aesthetic purposes is the field of the architect, designer, color consultant or decorator. The successful use of color as a decorative medium requires knowledge, training and creative or artistic ability. The extent to which the illuminating engineer is equipped in these respects will determine the degree to which he should undertake to function in this field. It is not a part of his responsibility as a professional engineer, and unless fully qualified, he should leave the purely decorative function to others. However, the illuminating engineer should cooperate with the decorating specialist to insure that the basic requirements of good lighting and decorative objectives are achieved.

2. Effect of Color on Vision

In view of the lack of completely summarized data as to the effect of color on vision, your committee has undertaken to evaluate much of the known information on this subject, and to report on the following question: "In a given type of occupancy, what effect can the color of the light source and the environment be expected to have on the effectiveness of the illumination in the performance of a seeing task, and the emotional or psychological response of the individuals?"

2.1—*Effect of Color on Visual Performance* — This involves two closely related considerations: ability to see, and comfort or ease of seeing. The first is concerned with visibility and acuity which can be evaluated by physical or psychophysical methods. The second involves such matters as fatigue and nervous strain which generally are subjectively or indirectly evaluated. Obviously both of these are influenced by each other and by the emotional and psychological aspects of the question.

Among the many factors involved in evaluating ability to see and visual comfort are visual acuity, rate and accuracy of performance, color adap-

Approved by the Council of the Illuminating Engineering Society, October 14, 1954.

tation, color discrimination, nervous tension and fatigue. Though not complete, this list indicates the complexity of the problem.

2.1.1—*Color in Relation to Ability to See* — Although the literature is voluminous, and the objectives, experimental techniques and viewpoints reported vary greatly, certain conclusions can be reached.

(a) So far as the color of the illuminant itself is concerned, no real practical advantage has been demonstrated for any particular color over any other.

(b) Within the task area alone, that is the task and its immediate background, brightness contrast is much more important for perception (visibility, acuity, etc.) than color contrast. Where a sizable brightness contrast exists, color contrast adds little, if any, to visibility, acuity and legibility. For example, two grays of sizable brightness contrast will yield legibility measures as good, or very nearly as good, as two colors bearing the same brightness contrast. On the other hand, when brightness contrast is limited, chromatic differences may increase visibility, acuity and legibility.

(c) Attention value is an essential attribute of color. While investigators are not in complete agreement as to which colors are most effective in this regard, the attention value of any color is increased when it is set off sharply from its surroundings.

(d) For the entire visual environment (walls, ceilings, floors, etc.), the brightness relationships among various areas are the governing factors insofar as ability to *see* is concerned. If psychological factors are excluded, such as personal preference, environmental color plays a very minor role in visibility, acuity and legibility. Obviously, the above points do not include specialized tasks such as color discrimination and matching, where even relatively small changes in the spectral distribution of light or visible surround may produce rather important effects upon seeing. For example, certain colors of illumination have been used to advantage in the detection of color differences in printing proofs. Nor do these conclusions in general apply to deeply saturated colored light, such as blue, green or red. However, in special cases, in which such colored light is essential, the brightness contrast in the visual task is an all-important factor.

2.1.2—*Color in Relation to Ease of Seeing* — Considerably less study has been made of comfort, or ease of seeing, than of visibility with various colors of task and illuminant. In general these researches indicate that brightness relationships are of greatest importance and that color relationships are significant primarily to the emotional and psychological aspects of the problem. This does not relegate the latter to a minor position. It is generally accepted that prolonged exposure to a psychologically undesirable environment may produce a decrease in visibility and increase fatigue and nervous strain.

2.2—*Emotional and Psychological Effects of Color* — This is the most difficult part of the question to answer. There are relatively few facts and they are of a very general nature. What are generally called the "emotional" and "psychological" effects of color are likely to be limited to more immediate perceptual reactions such as pleasant-unpleasant, attractive-repellent, or stimulating-depressing. Much more has been claimed but there appears to be little evidence substantiating such claims.

It is observed that colors with considerable red have a warmer tone than those similarly colored with blue. In fact, colors near the red end of the spectrum are called "warm" colors and those at the blue end "cool" colors. While the psychological effect described as "coolness" or "warmth" is generally accepted, it has not been established that such environments actually make people feel the physical temperature is higher or lower.

It has been demonstrated that color can help speed recovery of convalescents by providing a pleasant environment. Whether color has a distinct therapeutic value or to what extent it can be harmful to health is not known.

Decorators make use of color and color combinations for effect on the character or mood of an environment as to whether it will be gay or somber, lively or quiet, emotional or practical, rich or austere. Involved, as well as choice of color, are brightness contrasts, lighting effects and accessory equipment.

Other effects attributed to color include its use to alter the apparent dimensions or proportions of a room, making the room seem larger or smaller, longer or wider, and the ceilings higher or lower. Dark colors, by obscuring surface details, shadows and highlights, are considered to make solid objects seem smaller and heavier, while light colors are thought to make them seem larger.

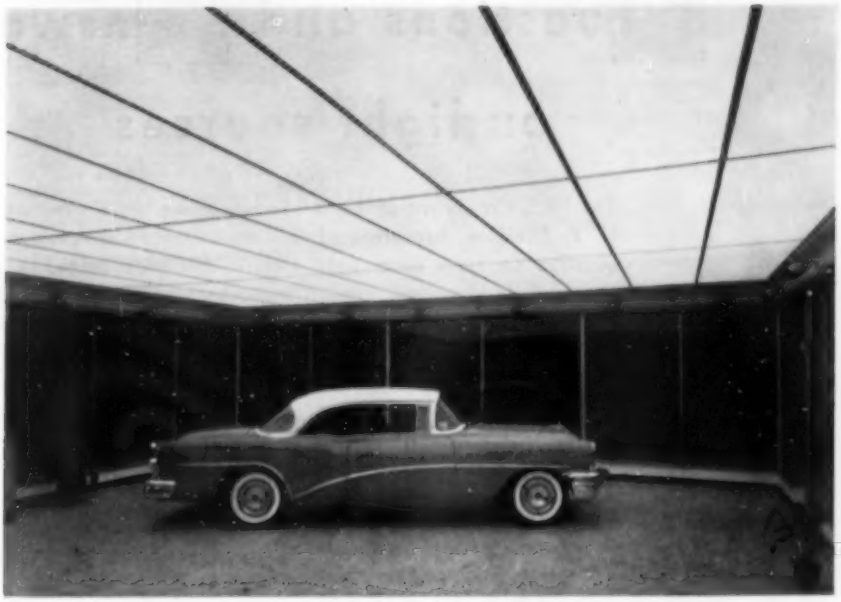
For the present it seems possible to affirm the following:

(a) On certain percentages of a given population, at a particular time, simple reactions or associations may be produced by color. These include brightness, variety, contrast, space, dinginess, cleanliness, stimulation, relaxation, disquietude, irritation, etc. It is certain, however, that a given light-material combination will not give Furthermore for any particular individual, the responses will vary in kind and intensity over periods of time, and they are particularly susceptible to group influences.

(b) Such feelings or impressions are probably only in part inherent functions of the color. They result mainly from sociological and environmental associations, including the home life of the individual, unconscious recollections of experiences associated with colors, the cultural pattern of the nation and community, teaching, daily contacts and advertising.

(c) In this field one is dealing primarily with likes and dislikes associated with or applied to specific objects or situations. "We like meat which appears red, not moldy; we are attracted by fresh, healthy looking faces; we like clean looking rest rooms, extreme color contrast in amusement parks, restful colors in libraries."

To produce the intended psychological effect with color (either light or material) requires skill on the part of the designer or decorator. Essentially this is in the field of creative art, calling for a thorough understanding of the fundamentals of design and color usage. It should be obvious that if the illuminating engineer is to function in this field, he must be fully qualified.



INSTALLATION AT W. H. CAGE, THIRD AVENUE AND JONES STREET, PHOENIXVILLE, PA.

Lighting an Automobile Showroom

LIGHTING OBJECTIVE: To provide quality illumination in the sales area with accent lights to highlight automobiles near the show window.

GENERAL INFORMATION: This showroom is approximately 45 feet long and 34 feet wide. Ceiling height (floor to plastic) is 10 feet and the structural ceiling is 22⅝ inches above the plastic. Colors and reflectances are as follows:

Cavity above plastic ceiling	flat white	84 %RF
Walls	chrome yellow	60% RF
Floor	yellow and tan (marbleized)	30% RF

INSTALLATION: This luminous ceiling is formed by 96-inch T-12 standard cool white slimline fluorescent lamps (on Pittsburgh catalog no. B-196-16 channels) mounted in thirteen continuous rows 2 feet 3 inches on centers and 18 inches above Pittsburgh Luma Ceiling no. 10. Eleven Swivelier catalog no. B-81 canopy shade units, each using a 150-watt R40 reflector spot lamp, are mounted just below the ceiling around the show window side of the showroom. The initial general illumination (after 100 burning hours) was 100 footcandles. Brightnesses are as follows: ceiling (at 45°), 266 ft-L; walls, 53 ft-L; floor, 30 ft-L.

Lighting designed by T. H. Gallagher, Lighting Engineer, Philadelphia Electric Company, 1015 Chestnut Street, Philadelphia, Pa.

Lighting data submitted by George T. Anderson, Jr., Philadelphia Electric Co., 1015 Chestnut Street, Philadelphia, Pa., as an illustration of good lighting practice and to aid in the design of similar installations.

Published by the Committee on Publications of the Illuminating Engineering Society, 1860 Broadway, New York 23, N. Y.

Series XX 8-55

A.I.A. File No. 31

Questions and Answers on light sources

The I.E.S. Committee on Light Sources, under the chairmanship of H. F. Davidson, has prepared this discussion as an answer to a question on radio noise from electric discharge lamps. Readers are invited to submit similar questions of general interest on light sources. Questions should be sent to Society headquarters.

Radio Noise from Electric Discharge Lamps

The fluorescent lamp is a low-pressure electric-discharge device, and generates a limited amount of energy in the radio spectrum when operated at 60 cycles. From the beginning, it was recognized that some fluorescent lighting installations would call for special recommendations to avoid radio interference. Laboratory and field tests started in 1939 resulted in the design of two types of filters for the suppression of line noise, the selection depending on location and installation conditions.

The small amount of radio energy generated at the lamp electrodes takes the form of (1) direct radiation from the bulb of the lamp, (2) radiation from the wiring, and (3) conduction through the wiring. Direct radiation from the lamp produces a weak field which is limited to 4 to 10 feet, depending on the length and wattage of the lamp. Line noise is attenuated considerably by the ballast and circuit wiring; when filters are installed as recommended, line noise is practically eliminated.

Frequency and Amount of Interference

The broadcast frequencies from 550 to 1600 kilocycles are most affected. Fig. 1 illustrates the approximate level of interference corresponding to various frequencies for the 40-watt fluorescent lamp. Other lamps generate interference at frequencies which approximate this curve shape but the level of noise will vary with lamp rating.

In general the radio noise is not additive and therefore the total amount of interference from any fluorescent installation will correspond to the single lamp producing the most interference. Since the amount of radio noise varies considerably from lamp to lamp, the curve in Fig. 1 was plotted from data taken on the lamp which produced the greatest amount of interference with no filters applied.

Direct Radiation

The radio energy transmitted by the bulb of the lamp is dissipated within a few feet, and therefore can be controlled by proper positioning of the radio and its antenna. The table below shows the minimum recommended distance between lamp and radio.

Lamp Type	Minimum Separation in Feet Between Lamp and Radio
14-watt	4
15-watt	4
20-watt	4
30-watt	6
32-watt	5
40-watt	8
90- & 100-watt	10
72-inch & 96-inch slimline	10

In case the radio must remain within the bulb radiation range, the following precautions are necessary:

(1) Connect the antenna to the radio by means of a shielded lead-in with the shield grounded or install a "doublet" type antenna with twisted pair leads.

(2) Provide a good ground for the radio.

(3) The antenna proper must be out of the bulb radiation range. Radios equipped with built-in antennas present a more difficult problem when located within the bulb or line radiation range. However, some radios of this design are also equipped with separate antenna and ground connections in order that an outside antenna may be provided.

Line Radiation

The service lines may act as an antenna to radiate interfering radio waves to the receiving set or to transmit the energy directly to the radio through the power supply. The field of radio energy surrounding the service lines is known as line radiation. With fluorescent lamps, the field of interference around the lines corresponds roughly to

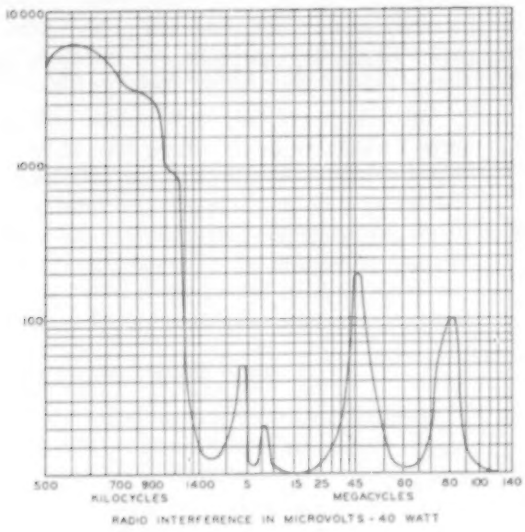
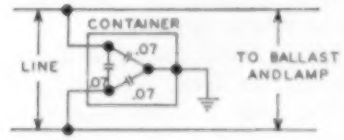
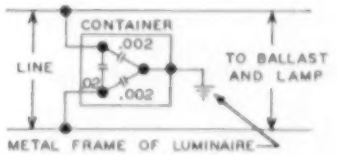


Figure 1.



CAPACITOR VOLTAGE RATING	CAPACITANCE IN Mμ F
240	.07-.07-.07

Figure 2.



CAPACITOR VOLTAGE RATING	CAPACITANCE IN Mμ F
240	.02-.002-.002

Figure 3.

that of bulb radiation, so protecting the antenna circuit against bulb radiation will also eliminate line radiation.

Line Feedback

The radio energy conducted from the lamp through the service lines is known as line feedback. This energy is often dissipated before it reaches the radio due to the impedance of the line. Accordingly, the shorter the power circuit from lamp to radio, the greater will be the possibility of line feedback.

Most automatic starters and instant-start ballasts (except the 120-ma size) are equipped with a small condenser to minimize line radiation and line feedback. Slimline lamps operating at 120-ma do not produce enough interference to justify the condenser. The condenser reduces line radiation and line feedback in the broadcast range in a ratio of 25-50 to 1, depending on the frequency and the type of lamp. The reduction is sufficient in most cases to satisfactorily minimize line noise generated by 14-, 15-, and 20-watt lamps. However, lamps of higher wattage may produce enough radio energy to require additional filtering.

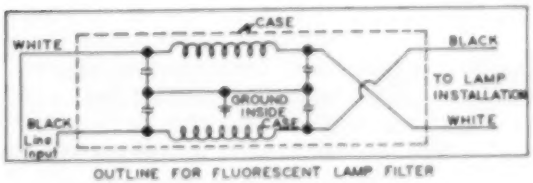


Figure 4.

General Recommendation

In view of the wide variety of applications of fluorescent lamps and the variation in radios and antennas, it is impractical to attempt a blanket recommendation covering all cases of radio interference. For this reason, the filters shown in Figs. 2 and 3 have been designed to take care of various installation conditions.

The ideal method of reducing both line radiation and line feedback is at the point of origin. This can be accomplished through proper application of line filters at each lamp or fixture. The function of the filter is to suppress radio energy and by-pass it to the ground.

The simplest forms of filters are shown in Figs. 2 and 3. Fig. 2 is a three-section delta-connected capacitor. In many installations this capacitor provides satisfactory reduction of line noise. It is recommended that one capacitor be installed in each fixture, as close to the ballasts as possible and with the metal case of the capacitor connected to the grounded luminaire. This capacitor filter is recommended for permanent installations such as ceiling fixtures and wall brackets where the metallic can of the capacitor can be permanently grounded.

The filter shown in Fig. 3 is similar in design, but contains smaller capacitors. This filter is recommended for use in portable lighting equipment

where the frame of the fixture cannot be connected to a permanent ground.

In many cases, it is desirable to reduce line noise to a very low level. Examples are localities such as rural areas or well-shielded buildings where the station signal strength is low and the radio volume control must be turned to an advanced position for reception. The receiver then becomes sensitive to low levels of interference. Installations in radio stores, radio service shops, electronic laboratories, and radio and television studios should also be filtered for maximum reduction of interference. For such situations an inductive-capacitor filter is recommended (Fig. 4).

While millions of fluorescent lamps are in use, a very small percentage are installed in locations where the operation of the lamp may interfere with broadcast reception. In the locations affected, the radio noise generated is almost without exception confined to the premises of the lighting installation, and the interference can be reduced to an unobjectionable level by following the above recommendations.

The cold-cathode fluorescent lamp is limited to relatively low current loading and produces only a small amount of continuous radio noise. The attention of the Committee was therefore directed to the hot-cathode type of fluorescent lamps.

Laboratory and field tests to date indicate that even without the use of filters, little or no continuous intereference with F.M. or television is expected as a result of fluorescent lighting. In circuits employing automatic starters the short pulse during the opening of the switch contacts produces the same effect on the television screen as the operation of any wall switch.

Other Electric-Discharge Lamps

Mercury and sodium lamps do not produce sufficient continuous interference to be considered sources of radio noise. During the period of electrode "warm-up," lasting for about 1 minute, interference of a random nature can be observed. While the lamp itself does not produce radio noise it is possible to obtain radiation and line noise from the components in the circuit such as the ballasts for photo-chemical lamps.

I.E.S. National Technical Conference

Time, September 12-16. Place, Hotel Statler, Cleveland, Ohio.

Technical Program —

Monday morning — Reports from National Officers.

Monday afternoon — Parallel sessions on (1) Light Sources, (2) Residential Lighting.

Tuesday morning — Parallel sessions on (1) Lighting Calculations, (2) Residence Lighting Forum.

Tuesday afternoon — Parallel sessions on (1) Lighting Applications, (2) Lighting Research.

Tuesday evening — Progress Report.

Wednesday morning — My Most Interesting Lighting Job Contest.

Wednesday afternoon — Parallel sessions on (1) Light Sources, (2) Lighting Applications.

Thursday morning — Architectural session.

Thursday afternoon — Parallel sessions on (1) Daylighting, (2) Street Lighting.

Friday — Committee meetings.

Entertainment —

Monday evening — Informal I.E.S. Futurama party.

Tuesday evening — Annual Progress Report.

Wednesday evening — Festive International outdoor dinner party at Nela Park. National groups will dance in native costumes.

Thursday evening — President's reception; banquet and dance.

Especially for the Ladies —

The schedule tentatively includes a basket brunch at Halles department store, 10:30 Monday. On Tuesday a trip to the Karamu Theatre and Tea at Shaker Heights. Lunch and fashion show at Higbees Wednesday noon. At least two sightseeing trips are scheduled on Thursday — a boat trip around Cleveland harbor and up the Cuyahoga River to see some of the industrial plants of Cleveland, unloading of ore boats and the operation of blast furnaces.

Lighting of Central Station High Bay Areas

Prepared by Subcommittee on High Bay Lighting of the Committee on Lighting of Central Station Properties, Illuminating Engineering Society

FOREWORD

The lighting of Central Station Properties, and especially generating and substation areas, presents seeing problems and conditions which are not typical of many work areas. Accordingly in 1948 the I.E.S. Council established a Committee on the Lighting of Central Station Properties to study conditions and prepare recommended procedures to serve as a guide for the industry. This report, the third of a series, deals with the Lighting of High Bay Areas.

It is planned that this report shall be in accordance with latest knowledge and practices. However, future progress in the art and science of illumination will doubtless make revisions of these recommendations desirable.

Subcommittee on High Bay Lighting

H. F. Carroll, Chairman

H. A. Cook D. J. O'Neill

Committee on Lighting of Central Station Properties

L. G. Parks, Chairman

A. A. Brainerd	C. E. Egeler
R. S. Bucher	R. M. Graves
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1. Introduction

1.1—*Basis of Report* — High Bay Areas of Central Station Properties are generally heavy equipment areas such as turbine rooms, pump areas, screen houses, miscellaneous boiler areas and service shops. Areas termed "High Bay" vary considerably in size according to function and ceiling or truss height. The mounting height of lighting equipment is usually related to the functional use of the area. The term "High Bay" as used in this report denotes areas where the mounting height of lighting equipment is thirty feet or more above the floor level. This report is based on a study of existing installations and practices and on the latest engineering data covering service requirements and available lighting equipment.

Approved by the Council of the Illuminating Engineering Society, October 14, 1954.

2. Seeing Tasks

2.1—*Basic Requirements*—The basic requirement for lighting High Bay Areas is high quality illumination on all working planes which will enable the personnel to observe and control effectively the operation and maintenance of various types of machines.

2.2—*Basic Problems*

2.2.1—*Vertical Illumination*—Vertical illumination is important as well as horizontal since it is necessary to read instruments and gauges, check bearings, operate valves, inspect screens and make minor repairs. For major repairs, portable localized lighting may be required. Safe and comfortable operation requires freedom from disturbing shadows and objectionable brightness differences.

2.2.2—*Spacing of Light Sources*—In High Bay Areas concentrated light sources mounted on wide spacings may produce heavy shadows. Increasing the number of sources and using closer spacing gives overlapping light distributions, reducing shadows and increasing the illumination on vertical surfaces. This same objective can be accomplished in some cases through the use of luminaires having a wider distribution. Fig. 1 compares the variation in illumination on the work plane from concentrating luminaires and a type with a broader distribution. Fig. 2 shows candlepower distribution curves of three typical types of high bay luminaires.

2.3—*Specific Application*

2.3.1—*Service Shops*—Service shops that fall into the High Bay category

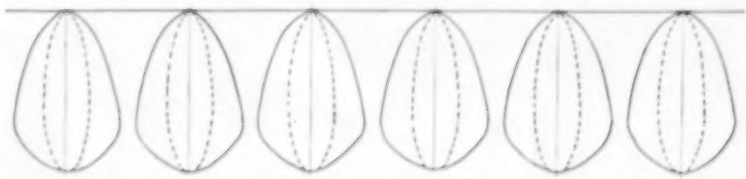

CONCENTRATING
21 10 22 11 22 11 22 11 22 10 21
MEDIUM SPREAD
24 29 28 30 29 30 29 30 28 29 24
INITIAL FT-C ON 30" WORK PLANE UNDER ONE ROW OF UNITS 42' 6" ABOVE FLOOR 30' ON CENTERS.

Figure 1. Comparison of distribution of illumination on the work plane from concentrating luminaires and those with wider distribution.

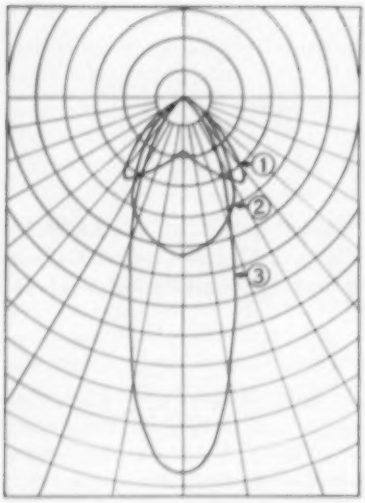


Figure 2. Typical photometric distribution patterns for high-bay luminaires: (1) spread, (2) medium spread, (3) concentrating. (See Section 5.1.1.)

Figure 3. Incandescent filament lighting in narrow high-bay area at a hydroelectric station.

with their wide variety of seeing tasks such as heavy machine, automotive, electrical and motor repair, welding and sheet metal fabrication and woodworking require high levels of illumination. This illumination should be provided in accordance with American Standard Practice for Industrial Lighting A11.1—1952. Fig. 3 shows a typical high bay service shop.

2.3.2—*Control Boards*—Control boards are sometimes located in High Bay Areas as shown in Fig. 5. Control board lighting is covered in the I.E.S. report entitled "Lighting of Central Station Properties — Part I: Lighting of Control Rooms."[1]

2.3.3—*Condenser Wells* — In general, adequate overhead lighting in the turbine room will be sufficient for lighting the condenser wells. See Fig. 6.

2.3.4—*Boiler Rooms*—Boiler platforms are usually irregularly spaced. In some cases high mounting heights are encountered due to lack of in-between structure. High Bay luminaires mounted on ceilings or walkways are used to illuminate platforms, feeder areas, coal scale areas, for general illumination, etc. (Figs. 7 and 8 show two examples.)

2.3.5—*Screen House*—Screen Houses are equipped with traveling cranes required to raise and lower screens, stop logs and trash racks. Mounting heights are high and vertical illumination is important since the principal task is the inspection and repair of the vertical surfaces of the screens and racks. Fig. 9 is a cross section of a typical screen house with both general and localized lighting.

2.3.6—*Pump Rooms* — Pump rooms, which in some cases fall in the category of High Bay lighting, are equipped with traveling cranes or mono-rails to service the pumps. Horizontal illumination is of prime importance, but sufficient vertical illumination is required for reading gauges and to carry on normal maintenance.

Figure 4. Combination incandescent-mercury vapor lighting in central station machine shop.

2.3.7—*Cranes*—In areas served by overhead cranes, supplementary luminaires should be provided on underside of cranes (as shown in Fig. 10) to eliminate crane shadows. Such luminaires are usually equipped with some type of shock absorbing device.

2.4—*Special Applications*

2.4.1—Some turbine areas are accessible to visitors in the interest of good public relations. In these instances it is desirable to provide higher levels of illumination than normally would be required for effective operating conditions. Fig. 11 is an example of such an installation.

2.4.2—*Architectural Features*—Certain architectural features of the area may be lighted to enhance their appearance. In keeping with this refinement, walls are often finished with attractive materials. The effective display of such interiors may require diffused general illumination to light the side walls and ceiling. Where visitors' galleries are located around the room above the turbine floor, extra luminaire shielding may be required above that indicated for viewing from the turbine room floor. See Fig. 6.

2.4.3—*Acoustic Treatment*—If acoustic treatment is used, this should be con-

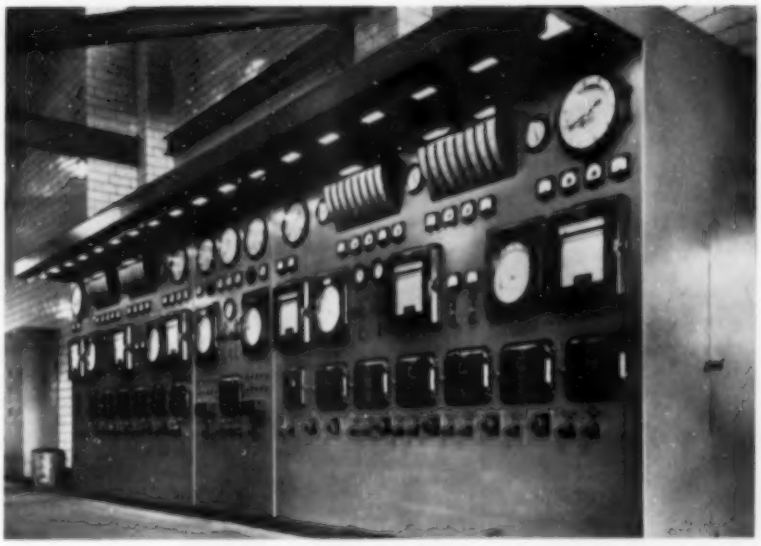


Figure 5. Free standing control board in high-bay area. Local lighting provided from built-on canopy.

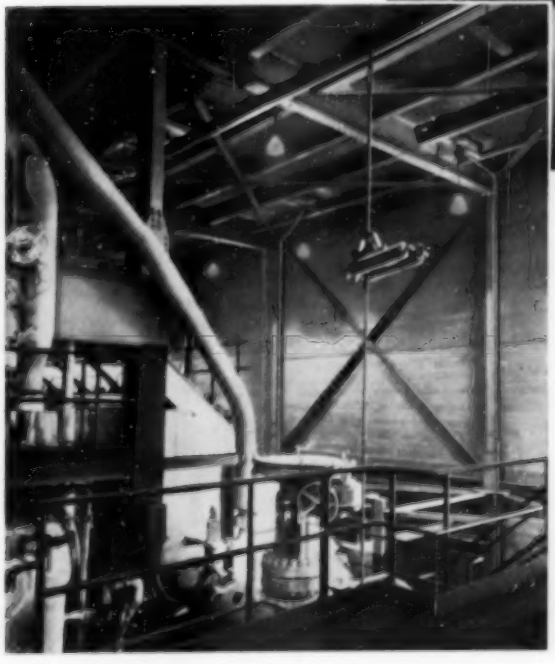


Figure 6. (above) View of condenser well lighted from general lighting system in turbine room ceiling. Lighting layout keyed to special acoustic treatment of ceiling and light tile walls. Note visitors' gallery.

Figure 7. (left) Incandescent lighting over irregular area in boiler room. Luminaires are installed on disconnecting and lowering hangers to facilitate maintenance.

Figure 8. (above) Localized general incandescent filament lighting in part of boiler room.

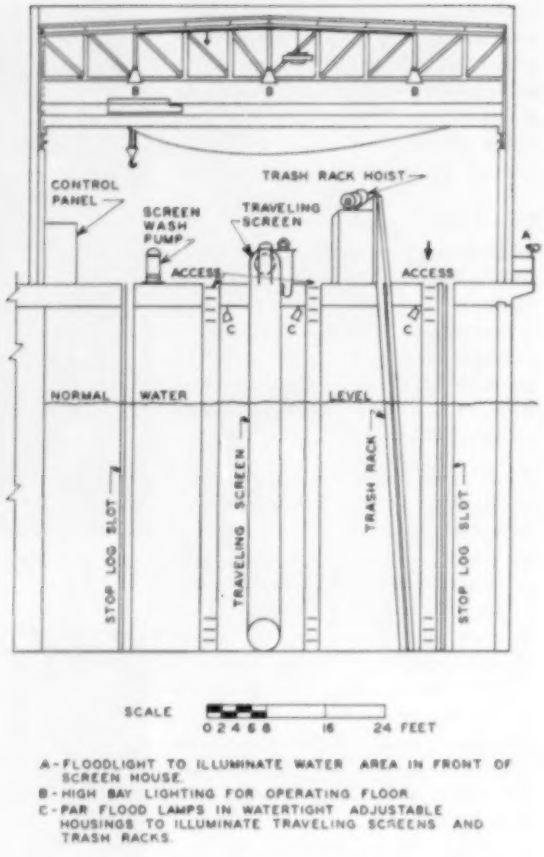


Figure 9. (right) Cross-section of typical screen house showing application of general and localized lighting equipment.

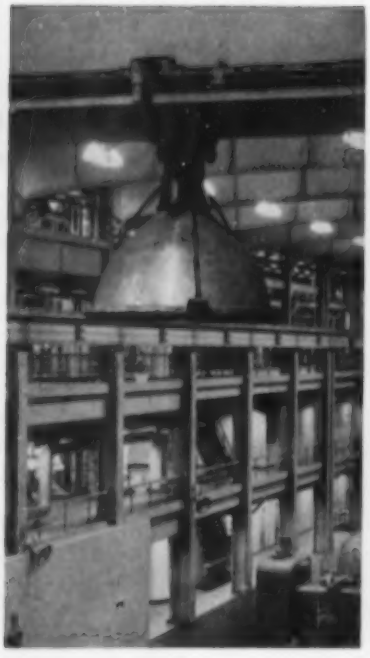
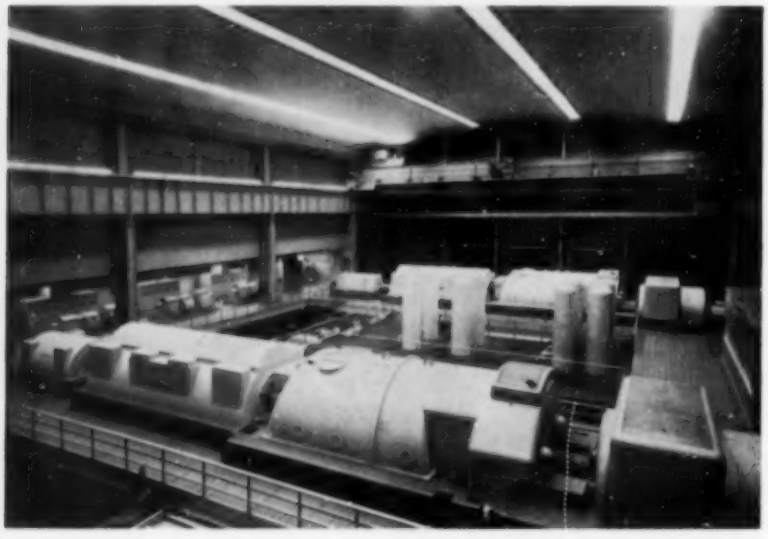


Figure 10. (left) Close-up of crane light with shock absorbing mounting pad.

Figure 11. (below) Turbine room open to visitors, lighted with continuous recessed troffers in acoustic tile ceiling. Walls, floors and machinery covers finished in light colors.



sidered in the selection and design of the lighting system. Examples are shown in Figs. 6, 11 and 12.

2.4.4—*Colors* — Brightness differences are reduced by the use of high reflectance finishes throughout the interior and luminaires which provide an upward component of light. Machinery should be painted in light colors; there is a trend today toward the use of pastel finishes, especially in turbine rooms which are displayed to the public. Light floors decrease contrasts and increase the general level of illumination.

3. Glare

3.1—*Direct Glare*

3.1.1—Direct glare from shielded light sources is not normally a problem in High Bay Areas due to the high mounting heights employed. A minimum shielding angle of 30 degrees should be provided; for best conditions 45 degrees is desirable. Fig. 13 illustrates the effect of the additional shielding.

3.1.2—Direct glare from daylight sources may be very disturbing if the construction is such as to provide glass

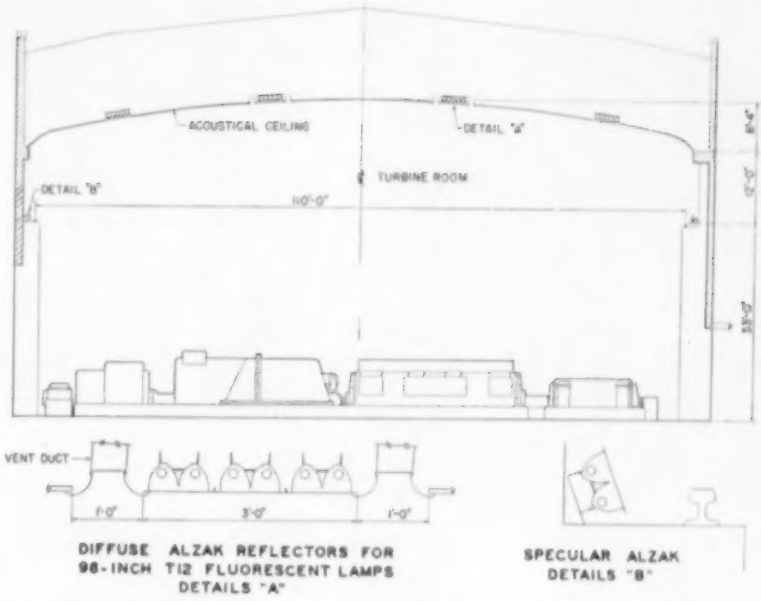


Figure 12. (above) Details of luminaire designs and installation in turbine room shown in Fig. 10.

Figure 13. (below left) Schematic diagram illustrating the differences between groups of high-bay reflectors with different shielding angles. In the deeper shielded group (45° cutoff) on left, the light sources may be visible in only *four* of the sixteen luminaires, while in the shallower shielded group (30° cutoff) on right, the light sources may be visible in ten of the sixteen luminaires.

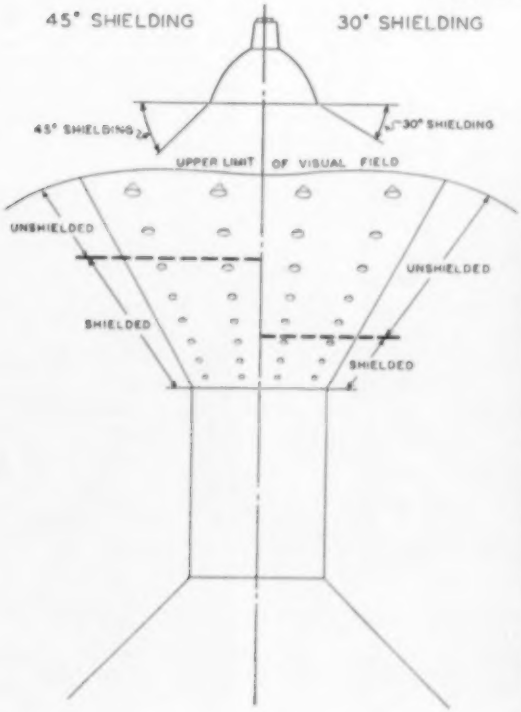


Figure 14. (below) Example of combination mercury-vapor incandescent lighting system in turbine room.

Figure 15. Example of combination fluorescent-incandescent lighting system in turbine room.

areas along the walls of the High Bay Areas. This problem should be given careful consideration during original design of building.

3.2—*Reflected Glare*

3.2.1—Reflected glare due to artificial light sources is seldom an important problem. Surfaces with glossy finishes will provide highlights, but of a low order which enhance rather than detract from the appearance of the area. If control boards are located in the High Bay Area reflected images of light sources in instrument glass will not ordinarily be troublesome since high angles of incidence are usually involved.

3.2.2.—Reflected glare from daylight sources may be disturbing in instrument glass of control boards. Locations of boards and daylight sources should be coordinated to eliminate such reflections. See Reference 1.

4. Recommended Illumination Levels

4.1—Levels of illumination recommended for central station high bay areas are shown in the accompanying table.

5. Effective Designs

5.1—*Area Classifications*

5.1.1—*High Bay—Narrow Areas*—In areas where the width is narrow in comparison with the length and the height approaches or exceeds the width, direct lighting equipment which concentrates the light toward the working area most efficiently produces the footcandles recommended. On the other hand, if it is the desire to emphasize the illumination on vertical surfaces including walls, a spread type of distribution may be used. A combination of distributions may be used to obtain required horizontal and vertical illumination for special lighting effects in some high bay areas. Calculations from photometric curves (see Fig. 2) will determine most suitable types of distributions for lighting horizontal and vertical surfaces.

5.1.2—*High Bay—Wide Areas*—In areas where the width is great, especially as compared with the height, both concentrating and spread types of distribution are applicable. Continuous linear sources (Fig. 15) will produce a greater degree of diffusion than individual concentrated sources.

5.2—***Lighting Systems***—Direct lighting systems employing incandescent filament, mercury vapor or fluorescent lamps, or combinations of such light sources provide flexibility of design selection.

5.2.1—*Incandescent Filament Systems*—Incandescent filament lamps are usually used in connection with specifically designed high bay reflectors. Several different light patterns are available, varying from a narrow to wide distribution, the use of which depends upon the ratio of mounting height to width (see Sections 5.1.1 and 5.1.2 and Figs. 1, 2 and 3).

5.2.2.—*Mercury Vapor Systems*—Mercury vapor lamps, plain or color modified, have advantages of longer life and higher efficiency than incandescent filament lamps. Specifically designed high bay luminaires with distributions comparable to filament are available for mercury lamps. Since the mercury lamp requires appreciable time to attain full output or restart, it is good practice to provide supplementary incandescent lighting.

5.2.3—*Fluorescent Systems*—When spread distribution is desired, fluorescent lamps in industrial reflectors may be used in high bay areas. (See Sections 5.1.1 and 5.1.2.) More concentrating distributions are available for fluorescent lamps in specifically designed luminaires, as shown in Figs. 11 and 12.

5.2.4.—*Mercury-Incandescent Systems*—When mercury and incandescent filament lamps are used in combinations (as in Figs. 4 and 14), the filament lamps compensate for the deficiency in

Recommended Illumination Levels

Area	Footcandles Maintained in Service on Horizontal Plane 30" above Floor
Turbine Rooms	30*
Service Shops	50**
Miscellaneous Areas such as Screen House, Pump Room, Boiler Room	20

*Where areas are available to the public higher levels may be desired.
**See "American Standard Practice for Industrial Lighting."[2]

red of the mercury. Percentages of the two range from equal lumens of the mercury and filament lighting to twice as much mercury light as filament light.

5.2.5—*Fluorescent-Incandescent Systems* — If a type of fluorescent lamp sensitive to voltage dips is used, the fluorescent system should be supplemented with incandescent lighting. See Fig. 15.

6. Maintenance

6.1—*Depreciation of Lighting Equipment*

6.1.1—*Luminaires*—The rate of depreciation of lighting equipment is dependent upon the atmospheric conditions and the type of equipment employed. One method of establishing a suitable maintenance schedule for cleaning is to check the illumination periodically with a light meter. When the illumination has decreased to two-thirds of its initial value the lighting equipment should be cleaned. A thorough cleaning of lighting equipment at least twice a year is justified in most locations. In dirtier areas three or four cleanings per year are needed to achieve the lowest cost operations in terms of footcandle-hours per dollar. With proper cleaning schedules an increase of 25 to 50 per cent may be realized in the average maintained illumination.

6.1.2—*Light Sources* — The output of all light sources diminishes with use and in many cases it is economical to replace lamps before they finally fail. With planned lamp replacement schedules, savings may be realized by replacing groups of lamps rather than individual ones. In addition, depreciated lamps are replaced by those at peak performance and a higher average lighting level results.

6.2—*Access to Equipment*—Means should be provided for easy access to all lighting units. Disconnecting and lowering hangers have been designed to permit safe lowering of lighting units for servicing. (See Fig. 7.) Various types of extension ladders and adjustable platforms, lamp replacement poles and other specialized equipment are available. In turbine rooms the luminaires are serviced from cranes.

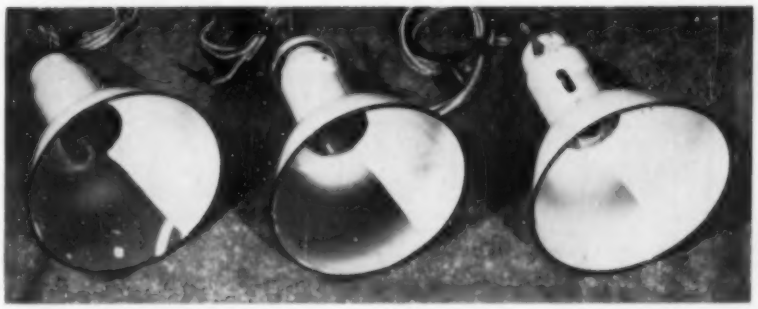


Figure 16. Porcelain reflectors partially cleaned to show dirt accumulation. All units were installed in the same area. At left, non-ventilated; center, ventilation at socket; right, four ventilating slits in husk.[13]

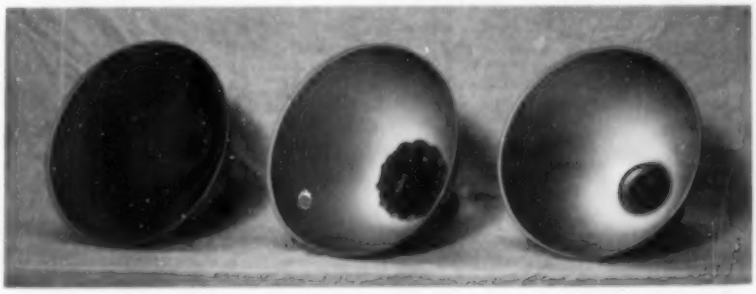


Figure 17. Alzak aluminum reflectors for mercury lamps. Left, non-ventilated; center, ventilated around base; right, husk ventilated. All were subjected to the same test conditions.

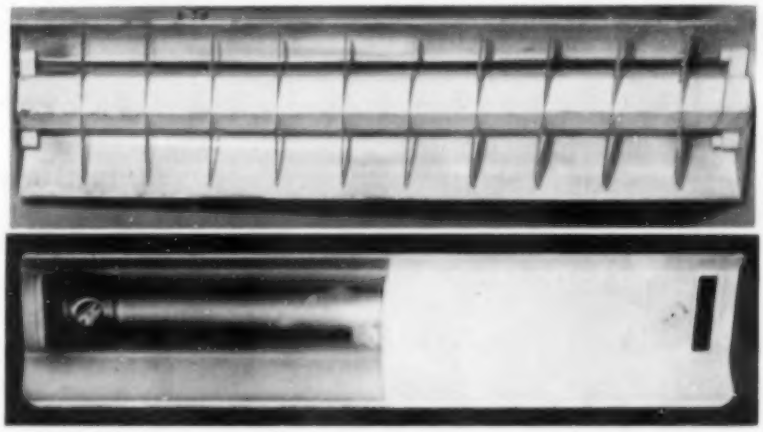


Figure 18. Fluorescent lamp luminaires indicate that dirt accumulates above lamps. Upper unit is ventilated, lower is not, but has been partially cleaned to show difference.

Figure 19. Lamps themselves become dirty with subsequent loss in light.

No.	Date of Installation	High Bay Area	High Bay Area Dimensions	Height of Area	Type of Illumination	Horizontal Ft-c at Working Plane	Watts per sq. ft. of Floor Area	Reflection Factor Upper Wall	Reflection Factor Lower Wall	Reflection Factor Equipment	Operating Hours of Fixtures per Day	Maintenance Period and Details	Daylight	Supplementary Lighting	Remarks
1	Spring 1949	Turbine Room	475' x 100'	49'	Merc.-Inc.	35.6	3.65	70%	70%	30%	24	Group replacement from crane	None	Control Board	Well satisfied
2	1950	Turbine Room	39,400 sq. ft.	58'	Inc.—750W; Merc.-Vap.—400W	20.0	1.75	20%	20%	50%	24	As relamp	None	None	None
3	June 1949	Turbine Room	287'6" x 106'	58'6"	Inc.—500W and Fluor.—4/40W	20-25	2.34	Not available at present			Supplementary to daylight and at night	Top of crane and special platform	Yes	None	None
4	Units 1 and 2 1941, 3—1948	Turbine Room 3 sections	446' x 65'	62'	Inc.	6	3.4	55%	55%	—	24	Semi-annual from crane	Yes	Yes	Require higher illumination level
5	12/42, 4/44 8/48	Turbine Room	276' x 100'	52'	Inc.—1000W	17	2.17	50%	50%	10-50%	14	When relamped	Yes	Crane, gages and panels	System is satisfactory
6	1932 and 1938	Turbine Room	450' x 60'	40'	Inc.	15	2	60%	60%	20%	24	When needed from crane	Very Little	Panels	System is satisfactory
7	Jan. 1949	Turbine Room	400' x 50'	49'	Inc.—1000W	10	1.72	35%	20%	10%	11	As needed from crane	Yes	Panels	Increase with Mercury
8	Mar. 1948	Turbine Hall	225' x 100'	60'	Inc.—750W and Merc.—400W	10	1.5	69%	69%	20%	24	As needed from crane	Yes	Under crane	System is satisfactory
9	May 1920	Turbine Room	200' x 100'	35'	Inc.	10	1	50%	40%	—	24	Monthly	Yes	———	Suggests higher intensity, Mercury and Incandescent
10	Unit 1, 1944 Unit 2, 1948	Turbo-Generator Room	120' x 100' extension 72' x 100'	47' 47'	Inc. and Merc. Inc.	Unit 1—12 Unit 2—10	Unit 1—1.2 Unit 2—1.25	60%	60%	30%	24	Yearly from crane	Yes	Major repairs only	None
11	May 1949	Turbine Room	280' x 60'	50'	Inc.—1500W and Merc.—400W	50	4.5	80%	50%	15%	24	———	Yes	None	Not in use long enough
12	1943	Turbine Room	170' x 100'	80'	Inc.	20	2.8	Large window area			24	As needed from crane	Yes	None	None
13	1945	Turbine Room	270' x 60'	46'	Inc.—1500W and Merc.—400W	25	2.1	—	—	—	18-24	As needed from crane	No	Panels	Installation is satisfactory
14	Sept. 1948	Turbine Room	132' x 100'	38'6"	Inc.	25	2.6	80%	70%	60%	14	Every 3 months from crane	Yes	None	None
15	July 1948	Hydro-Generator Room	228' x 53'	44'	Inc.—1000W	20	2.5	65%	65%	30%	10	As needed from crane	Yes	Emergency repairs	None
16	1949	Turbine Room	135' x 90'	46'	Inc.—750W and Merc.—400W	35	2.7	48%	48%	40%	15	Approx. 750 hr.	Yes	None	None
17	June 1948	Turbine Room	280' x 40'	30'	Fluor.—4-40W	55	2.93	30%	30%	—	24	3 months from crane	Very Little	300W Inc.	None
18	1948	Turbine Room	191' x 56'	41'	Inc.—1000W	16	2.3	48%	48%	40%	15	Approx. 750 hr. special catwalks	Yes	None	Satisfactory installation
19	Sept. 1948	Turbine Room	130' x 80'	46'	Inc.—1000W	23	3.3	40%	40%	35%	20	Not definite	Yes	None	None
20	April 1949	Trans Service Shop	160' x 53'	31' (units)	Inc. and Merc.	35	4.24	70%	Open	15%	10	Semi-annual	Yes	None	None
21	1930	Turbine Room	166' x 50'	40'	Inc.—1500W	15	5	20%	20%	40%	12	As needed	Yes	Panels	None
22	July 1947	Turbine Room	149' x 53'	39'6"	Fluor.—2-100W Inc.—1500W	40	2.5	50%	50%	50%	10	As needed	Yes	None	None
23	1949	Turbine Room	100' x 60'	50'	Direct Inc—750W	12	1.9	40%	40%	30%	12	Not known	Yes	None	None
24	May 1949	Generator Room	77'6" x 38'6"	32'4"	Inc.—750W Merc.—400W	15	3.1	50%	50%	35%	12	Several months from crane	Yes	Panels	None
25	Mar. 1948	Pump Room Water Con. Sta.	83' x 30'	35'	Inc.	—	2.4	62%	62%	30%	24	No fixed schedule from crane	Negligible	Fluorescent at Control Board	None
26	1948	Turbine Room	— x 100'	50'	Inc.	15	2.28	15%	30%	10%	24	No schedule from crane	———	Portables for repair	Will use lighter colors in future
27	1948	Turbine Room	176' x 94'	41'	Inc.—1000W and Merc.—400W	20	2.7	65%	45%	30%	18	Approx. 6 months from crane	Yes	None	None

6.3—*Collection of Dirt*—Important factors to consider in the selection of lighting equipment are rate of dirt collection and ease of cleaning. Open-bottom luminaires have the advantage of no bottom surface to collect dust and dirt. Closed bottom units of the dust tight variety are often used to prevent dirt accumulation on the lamps and reflecting surfaces. Considerable care must be exercised during relamping to insure adequate sealing against dust as a very small defect in gasketing will allow the fixtures to breathe in dirt.

Service tests[13] on open type units (Figs. 16, 17 and 18) indicate that dirt accumulates at a lower rate in units designed with ventilating areas around the top of the unit. With this construction the air movement through the unit tends to carry airborne dirt through the luminaire rather than depositing it on the reflector and lamp.

Appendix A — Case Histories

In order to obtain some cross section of current practice in high bay lighting, a questionnaire was submitted to all sustaining members of the Illuminating Engineering Society who are listed as central station properties. Forty-six replies were received giving information on twenty-seven high bay areas. These twenty-seven areas are described on the facing page. The following is a condensation of this information:

Number of companies replying	46
Number of companies reporting usable information	27
Number of installations reported on	27
Number of installations 10 years old or older	5
Number of installations 5 to 10 years old	3
Number of installations less than 5 years old	19
Type of Lighting Units:	
Incandescent	15
Mercury and Incandescent	10
Incandescent and Fluorescent	2
Fluorescent	1

Age of Installation	Illumination in Footcandles: Average Value	Range of Values
10 years or older	13	6-17
5 years to 10 years	18	10-25
Less than 5 years	26	10-50

Three companies report need for increased illumination. All of these presently have 10 footcandles or less.

Six companies report satisfactory installations. The average illumination in these installations is 20 footcandles. One company reports need for higher reflection factors.

Three companies report no installations which are satisfactory.

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1956 Regional Conferences—Tentative Schedule

April 5-7	Southern Region	Birmingham, Alabama
April 8-10	Southwestern Region	Fort Worth, Texas Hilton Hotel
April 15-17	South Pacific Coast Region	San Francisco, California
April 19-21	Pacific Northwest Region	Spokane, Washington Davenport Hotel
April 26-28	Inter-Mountain Region	Salt Lake City, Utah Utah Hotel
May 7-8	Great Lakes Region	Toledo, Ohio
May 10-11	Midwestern Region	Indianapolis, Indiana
May 17-18	Canadian Region	Quebec, Quebec Chateau Frontenac
May 24-25	East Central Region	Washington, D. C. Shoreham Hotel

Here and There with I.E.S. Members

Paid attendance was 199 at the annual joint dinner meeting of the Southern California Section with the Electrical Maintenance Engineers Association, June 15 in Los Angeles. Chief speaker was James C. Forbes, at right, of General Electric Co., whose topic was Fluorescent Lighting Installations — Must They Be Maintenance Headaches?

Outstate meeting of the Michigan Section, jointly with the Western Michigan Chapter, was held June 24, at the Indianwood Golf and Country Club, Lake Orion, Mich. Over 60 members and guests attended. Here Bill Monroe, program chairman is calling out prize winning ticket at the banquet.

Lighting Maintenance was the topic for discussion at the April 25 meeting of the Hamilton, Ontario Chapter, and attracted members of the Board of Education. From left to right, front row: Lloyd Spalding, Hamilton Board of Education; and Walter Diak of the Toronto Board of Education; rear: George Fridley, Allite Division, Donovan Construction Co. Ltd.; Rod Drysdale, A. V. Roe Canada Ltd.; Norman W. Bethune, Chairman, Hamilton Ontario Chapter, I.E.S., and George Ross, Chairman, Hamilton Board of Education.

TELECAST

LIGHTING NEWS OF CURRENT INTEREST

Midwestern Regional Conference — Model for Advance Regional Planning

If any I.E.S. Section or Chapter finds itself host for the first time to a Regional Conference, it could well make the first step a request for advice from the Midwestern Region. Midwestern members have long been masters of Intra-Sectional Organization; their advance planning on all details has always paid off in exceptionally successful conferences. The meeting at the Edgewater Beach Hotel, Chicago, May 2 and 3, for instance, attracted close to 300 members and wives from every group within the Region; every phase of the conference, technical or social, was of convention stature; enormous detail was handled without a hitch. Their method of early planning and organized operation of large numbers of their members was without doubt the contributing factor.

Committee Structure

Close to 100 people, from every Section and Chapter, made up the highly effective committee structure, all under the general direction of Glenn G. Boyd as General Chairman. Each committee was assigned a definite scope and a budget for its operation. Each chairman was a responsible experienced "doer," with a committee of conscientious workers and no "names." Committee meetings, separately and together, are held frequently starting a full six months in advance of the conference. The system adds up to a smooth-functioning operation of outstanding success. Detailed committee reports, covering all phases of each committee operation have been compiled for the guidance of future conferences, or other interested groups.

Technical Program

Twelve technical sessions were offered at the Midwestern Regional Conference, in addition to the contest for "My Most Interesting Lighting Job" and the Progress Report. Theme of the technical program was up-to-date basic education in important phases of practical illuminating engineering, and all papers were planned with this objective in mind. As with national conferences, advance preprints were made up for every paper and given to each delegate in a packet. The registration envelope also included a pre-registration list of all present, a letter of greeting, a list of interesting lighting installations to see in Chicago, a transit authority map and other pertinent literature. A system of checking badges at technical sessions gave an attendance count at these meetings; attendance was never less than 205 at all technical sessions.

Full details of the technical program are listed at the end of this report.

M.M.I.L.J.

The Midwestern Regional considered their contest for "My Most Interesting Lighting Job" a major part of the program, and entries represented winners of keenly contested local competitions. Two local contests, for example, had nineteen entries competing. The Regional Contest was held at the opening session May 2, with Leonard V. James, Duncan M. Jones, Maurice W. Ross, Carl W. Zersen and Charles N. Laupp serving as judges. Winners were:

First Place — Richard L. Garber, Milwaukee Section — "Revealing Hidden Beauty in a Church."

Attendance at Midwestern Regional

Central Illinois Chapter	6
Chicago Section	161
Cornhusker Chapter	3
Heart of America Section	4
Indiana Section	9
Iowa Section	22
Milwaukee Section	22
St. Louis Section	28
Twin City Section	14
Twin Ports Chapter	0
ALSO	
Cleveland Section	2
Connecticut Section	1
Michigan Section	3
New York Section	1
Ladies	60
	336

VIP's at the head table, at the Midwestern Regional, are, from left to right: R. R. Lusk, E. H. Church, President D. M. Jones, G. G. Boyd, J. R. Chambers, A. R. Larson, and William Weibel.

Beautiful sterling silver water pitcher was a present to President and Mrs. Jones.

Ernest Gallet presents attendance award to Brooks Chassaing, Chairman of the winning St. Louis Section.

Second Place — James K. Carlson, Twin City Section, "Lighting the First Congregational Church."

Third Place — Tie — Raymond C. Close, Chicago Section, "Relighting Drafting Room and General Office of the Rockford Engineering Co."

and George E. Ransford, Indiana Section, "Exterior Lighting of the Electric Building."

Social Program

The banquet May 3, preceded by a reception for President and Mrs. Jones was, of course, highlight of the social program. It was in fact a brilliant event attended by 350 members and guests. President and Mrs. Jones were presented with a sterling silver water pitcher as a memento of the Region. Other ceremonies at the banquet included awards to the winners of the M.M.I.L.J. contest, and a cash award to the St. Louis Section as winner of the Attendance Award. This intra-Sectional competition is based on attendance at the conference in relation to the miles traveled, and in percentage of the Section's total membership.

The fun part of the program started off with a Coffee and Punch Bowl Fellowship party Sunday evening, which grew into a pleasant custom of coffee breaks each morning of the conference. A golf-tournament was also part of the planned arrangements, and a special program was, of course, arranged for the 60 ladies registered. Entertainment of the ladies was under the direction of Mrs. Chester B. Thorsen. Again in national-convention style, the women attending the conference had their own Hospitality Headquarters, where they met every morning for coffee. It can safely be said there were no strangers at this conference. The program also included their own "technical session" held at the Chicago Lighting Institute, where they heard E. W. Commery's interesting talk and demonstration on home lighting, "See Your Home in a New Light."

A trip to Marshall Field's is, of course, a must to Chicago visitors. The Midwestern group included this in its agenda, with a luncheon and style show there the first day. Another special luncheon was arranged for them Tuesday at the Tam O'Shanter Country Club, followed by a bridge and canasta party.

Group inspecting equipment at the Progress Report.

Papers Presented

A detailed list of the papers presented at the technical sessions is as follows:

Monday — May 2, 1955

Glenn G. Boyd

Conference Chairman

Welcome by Arthur P. Larson, *Chairman*, Chicago Section.

Address by James R. Chambers, Vice-President, Midwestern Region.

My Most Interesting Lighting Job Contest — Charles N. Laupp, Midwestern Regional Contest Chairman.

Luncheon Address — Duncan M. Jones, President.

Monday Afternoon

Brooks Chassaing, *Chairman*

St. Louis Section

Plastics in Lighting — W. E. Brown, P .C. Woodland, R. J. Lee, Dow Chemical Co., Midland, Mich.

Application of Floodlighting to Buildings — Benjamin S. Benson, Jr., Benjamn Electric Mfg. Corp., Des Plaines, Ill.

Modern Trends in Mercury Vapor Lighting — C. W. Craig, Westinghouse Electric Corp., Chicago, Ill.

The Whys of Ballasts — Max D. Orr, Vice-President, Advance Transformer Co., Chicago, Ill.

President's Reception.

Dinner Dance.

Tuesday Morning — May 3, 1955

Donald R. Schwarz, *Chairman*

Twin City Section

Regional Activities Committee Breakfast Meeting.

High Current Fluorescent Lamps — C. L. Amick, General Electric Co., Cleveland, Ohio.

Application of 277- and 480-Volt Systems — J. B. Hodtum, Allis-Chalmers Mfg. Co., Pittsburgh, Pa.

Lighting for Underpasses and Underground Garages — Francis D. Wyatt, Chicago Park District.

Maintenance—The Key to Economical Lighting — Gerald M. Marks, Electro-Silv-A-King Corp., Chicago, Ill.

Practical Methods for Measuring and Evaluating Lighting Systems — George Clark, Sylvania Electric Products Inc., Wheeling, W. Va.

Luncheon Progress Report — E. W. Beggs, Westinghouse Electric Corp., Bloomfield, N. J.

Arthur P. Larson, *Chairman*, Chicago Section.

Tuesday Afternoon

Ralph E. Crockett, *Chairman*

Indiana Section

The Layman's Use of Glare Rating Systems — R. D. Bradley, Day-Brite Lighting Inc., St. Louis, Mo.

Entrants in the contest for My Most Interesting Lighting Job.

The Influence of New School Design on Lighting — Lawrence B. Perkins, Architect, Perkins and Will, Chicago, Ill.

Your Marketing Challenge of the Future — Hoyt P. Steele, President, Benjamin Electric Mfg. Co., Des Plaines, Ill.

Credit Due

More than 100 responsible and very competent men and women should receive credit for the success of this conference. The well-organized and extremely effective committee structure was under the specific guidance of Glenn G. Boyd as General Chairman, James R. Chambers, Regional Vice-President, and the following committee chairmen:

Vice-Chairman, Executive Committee
William A. Weibel

Secretary, Executive Committee
R. Ralph Lusk

Committee Chairmen

Attendance and Publicity .... Ernest H. Gallet
Entertainment ..... Ernest E. Elliott
Finance ..... Carl A. Bassdow
Hotel ..... Carl W. Zersen
Ladies Reception .... Mrs. Chester B. Thorsen
Lighting and Decorations ..... Carl F. Jensen
Papers and Program ..... Eric H. Church
Registration and Reception .... C. W. Clarkson
Transportation ..... Robert J. Diefenthaler

Section and Chapter Chairmen

Central Illinois Chapter ..... J. W. Regan
Chicago Section ..... Arthur P. Larson
Cornhusker Chapter ..... R. W. Gibb
Heart of America Section ..... F. P. O'Connor
Indiana Section ..... Ralph E. Crockett
Iowa Section ..... Richard Holcombe
Milwaukee Section ..... Thomas B. Dustin
St. Louis Section ..... Brooks Chassaing
Twin City Section ..... Donald R. Schwarz
Twin Ports Chapter ..... O. D. Hanke

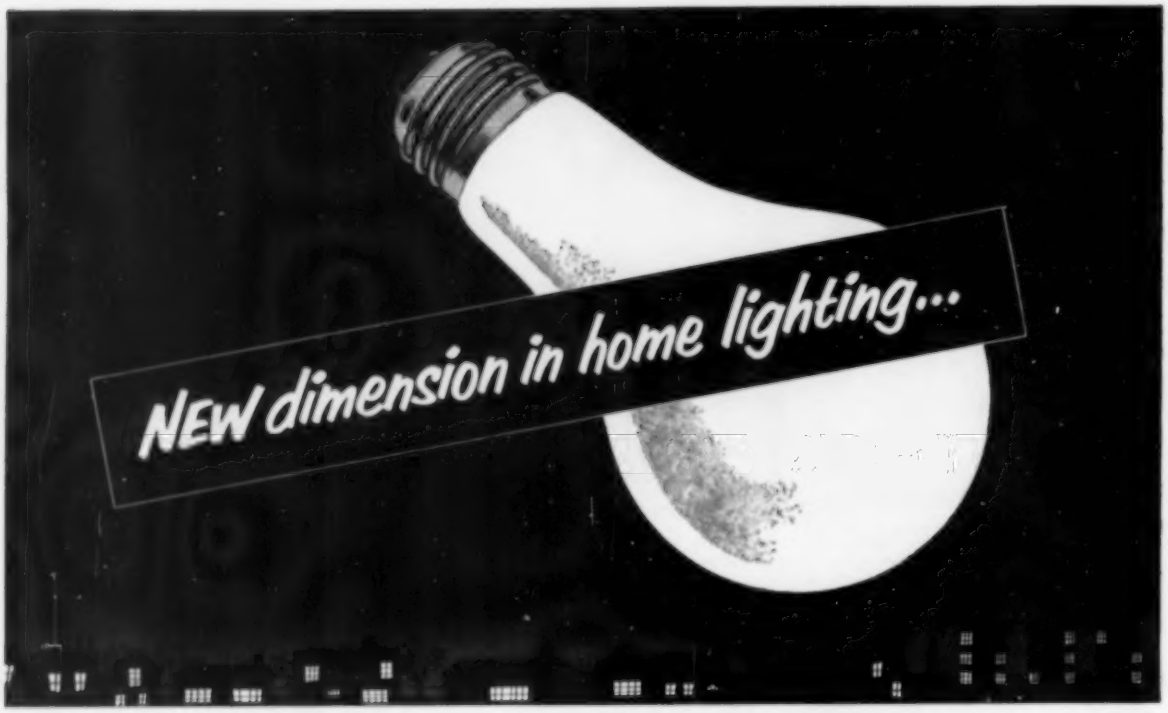
Quiet, Judges at Work — Deliberating on the merits of the MMILJ contest entries are: Maurice W. Ross, C. N. Laupp, Carl Zersen, Duncan Jones and L. V. James.

Three-Day Standards Conference To Be Held in October

Government and industry leaders will join forces in a public discussion of their relative roles in standardization at the Sixth National Conference on Standards, in Washington, D. C., October 24-26. The National Bureau of Standards and the American Standards Association are co-sponsoring the three-day meeting, which will be held at the Sheraton-Park Hotel. Subjects to be covered will range from the legal implications of standardization to the coordination of Defense Department and industry requirements for manufactured products, focusing on the conference theme of cooperation between industry and government departments and agencies in the field of standardization.

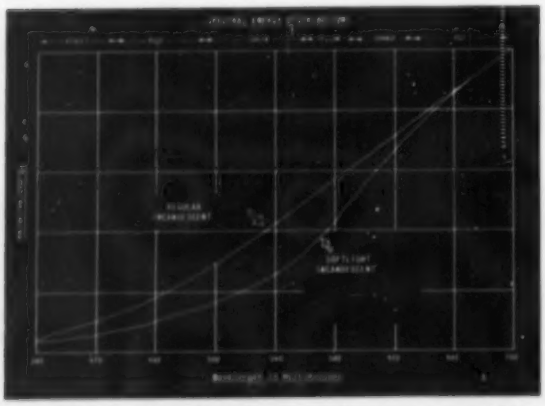
Further details, programs and registration forms may be obtained from the American Standards Association, 70 East 45th St., New York 17, N. Y.

(Continued on page 11A)



Sylvania Softlight

pearl-pink bulb decorates as it illuminates



New Sylvania Softlight spectrum has greater quantities of warmer colors than regular incandescent lamps. More perfect diffusion, for sake of aesthetic appeal, cuts down over-all lumen output slightly.

Homeowners nationwide are buying up new Sylvania Softlight bulbs. Here is the long sought new dimension in home lighting . . . the newest concept in interior design. Now, beyond the basic dimensions of *quality* and *quantity* of light, Softlight captures the third dimension of *aesthetic appeal*—brings exciting new warmth, cheer, color accentuation into the home.

Softlight bulbs carry a special pearl-pink coating which filters out cooler colors of the spectrum—blue, green, yellow—and plays up the warmer hues. Greater masking of the filament softens, shadows, reduces glares. *Result:* a warm, pleasing, off-white glow that harmonizes with and favors warm-colored furnishings . . . flatters human complexions as well.

Yes, *decorating with light* is exciting news for you too! Be sure *you* have all the facts . . . send the coupon below for complete information. A Sylvania lighting specialist will call if you wish.

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☐ Have a Sylvania lighting specialist call to demonstrate Softlight to me.

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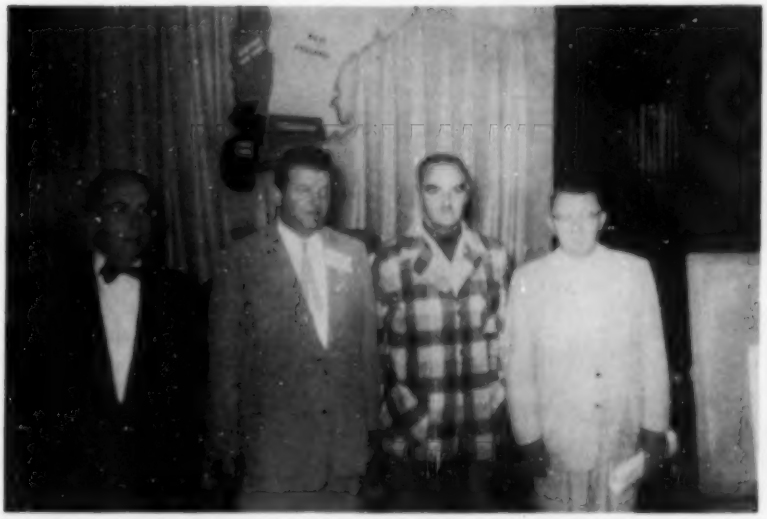
Organization_____

Address_____

City_____ Zone_____ State_____



At the Lake George Conference: H. H. Friedman, Chairman, Eastern New York Chapter, host to the Region; C. W. McCormick, Regional V-P; President D. M. Jones; C. E. Waldron, General Chairman of the Conference.

Eastern New York Section Host to Regional Conference at Lake George

When a member can enrich himself with the latest information on lighting techniques, and at the same time enjoy the pleasures of a resort area as lovely as Lake George, N. Y., he can surely feel he has attended a very successful I.E.S. meeting. If the beauties of Lake George are what influenced his attendance, then the excellence of the program was a big added dividend, and vice versa.

Heretofore, Northeastern Regional Conferences have been handled by experienced old hands like New York or Boston. The relatively new group in Albany, however, host to the Lake George Conference June 10-12, set a brand new pace. Under the leadership of C. E. Waldron, Conference Chairman, and C. W. McCormick, Regional Vice-President, an excellent program was offered, featuring ten major papers. Excellent enough, as a matter of fact, to compete successfully with June sunshine and the wicker chairs of the Fort William Henry terrace. Details of the program are given farther on in this report, for the record.

Actually, the Conference got under way two days before its billed date, with the arrival from all parts of the country of I.E.S. Council members, June 9. One of the largest Council meetings in I.E.S. history was held at the Fort William Henry Hotel, Lake George, June 10, just prior to the Regional meeting (see July 1955 I.E., page 5A). On the eve of this meeting, Council members and their wives were entertained by Regional V-P Wes McCormick.

Social Program

The Entertainment Committe for this Conference had everything on their side—the locale, the season, and the weather. To these natural advantages they added plans for a full-scale convention-style social program. The banquet, in the huge dining room of the hotel, was such a success that the merry-makers passed the hat to keep the orchestra for hours longer, past its closing. Door-prizes, party favors for all, corsages to every lady, summer dresses and white dinner jackets, an especially good dance orchestra, an evening in June, no speeches. These were some of the things that made it memorable, but they planned for laughs too. Representatives from General Electric (Sam Hazelton), Westinghouse (Marshall Waterman) and Sylvania (Dr. Lowry) all received golden boxing gloves with the appropriate initials. Harold Friedman won a Davey Crockett hat for his champion hosting. One laugh they hadn't counted on was the spectacle of the staidest of I.E.S.'ers dancing in their stocking feet. The hotel put too much wax on the floor, and with shoes one could only skate.

There were several touching ceremonies at the banquet too. Mrs. W. F. Little, wife of the President of Electrical Testing Laboratories was honored by a gift from the Region, and a standing ovation from the delegation, for her attendance at 35 I.E.S. National Conventions, and numerous Regional Conferences. A group of eight members and wives from the Canadian Region who drove down across the border as a courtesy to their neighboring Region, and to their fellow Canadian President Jones, were honored with the playing of their national anthem, and a toast to the Queen. President and Mrs. Duncan M. Jones received gifts from the Region: a resort-area sports jacket for Mr. Jones, a leather resort carry-all for Mrs. Jones.

The nature of things added greatly to

(*Continued on page* 12A)

Intra-Section and Regional problems were discussed during Regional Activities luncheon at Lake George. Mr. Waterman was chairman; some 15 incoming and incumbent local officers attended.

Charter for Section status is presented by D. M. Jones to H. H. Friedman, Chairman of this fast-growing Albany group. Eastern New York had received its Chapter Charter in June of 1952.

Entries in the Northeastern Region's contest for My Most Interesting Lighting Job: l. to r., V. J. Rogers, Connecticut Section, Third; R. H. Rice, Eastern New York Section, First; Walter Greenwood, New York Section, Second.

(Continued from page 11A)

other aspects of the social program. Luncheon recess from technical sessions on Friday was held on the rolling green lawns of Lake George, buffet tables under the trees. A delightful summer day with just the right temperature turned luncheon into a memorable event. Coffee breaks, and pre-dinner cocktails were on the Fort Henry terrace, where the ladies joined the delegates. Even a a summer thunderstorm rolling up over the lake dampened only the countryside.

In addition to joint events with the men, a special program for the ladies included boat rides on Lake George, shopping expeditions in the resort areas, arrangements for golf. The women's program was in the capable hands of Mrs. Lee Bass.

M.M.I.L.J.

As with many of the other Regions, the contest for "My Most Interesting Lighting Job" was a popular highlight of the technical program. Every Section was represented with an entry, and the contest was well organized, with a chairman (C. D. Hollister) guiding all phases of it. Mr. Hollister opened this session with a most interesting talk outlining the history of this contest and its value to salesmen and distributors within the lighting industry.

Judges at the Northeastern contest were Will Fisher of Cleveland, R. F. Hartenstein of Akron, Joe Thomas of Montreal, Wes McCormick and Duncan M. Jones. Their deliberations resulted in the following:

First Prize — R. H. Rice, Eastern New York Section, for his lighting of a small private airport.

Second Prize — Walter Greenwood, New York Section, for his method of relighting the dome of a Russian Orthodox Church.

Third Prize — Valentine Rogers, Connecticut Section, for his installation at the Methodist Church in Waterbury, Conn.

Fourth — L. E. DuVal, Jr. (Stan Baker was proxy) of New England Section, the relighting of a store.

Technical Program

The Conference was declared open Friday morning, June 10, by Harold Friedman, Chairman of the Eastern New York Chapter, which after only three years of existence was already the successful host to a major conference. First business on the agenda was the presentation of this group's Charter as a Section, presented to Mr. Friedman by President Duncan M. Jones.

Addresses by both Regional V.P McCormick and President Jones led off an excellent program of technical papers. One helpful touch in this connection, was an easel bearing the speaker's name in letters large enough to be seen from all parts of the room. The host Section had also prepared a decorative backdrop formed by the geometric outline of the Region, and the props committee were quite obviously on the job with lights, and all necessary equipment.

A Local Activities luncheon followed the close of the sessions Saturday afternoon, which was attended by sixteen officers of the Region's local administrations, together with national officers and headquarters staff. Marshall Waterman presided, and led an open forum on successful experiences in local I.E.S. practice.

A detailed list of the papers presented is here given for the record:

Technical Sessions

Friday Morning — June 10

Presiding — C. E. Waldron, Chairman
Northeastern Regional Conference

The Conference Is Open — Harold H. Friedman, Chairman, Eastern New York Chapter.
Address of Welcome—C. W. McCormick, Vice-President, Northeastern Region.
President's Address—Duncan M. Jones, President, Illuminating Engineering Society.
Fluorescent Street Lighting Practice—Kirk M. Reid, General Electric Co.
The Fluorescent Lamp, Yesterday — Today and Tomorrow — Dr. E. F. Lowry, Sylvania Electric Products Inc.

Friday Afternoon

Presiding — C. D. Hollister,
Program Chairman
Northeastern Regional Conference

Visual Comfort Indices—Will S. Fisher, General Electric Co.
The Effect of Light Sources on the Development of Architectural Design — Harry E. Rodman, Rensselaer Polytechnic Institute.
My Most Interesting Lighting Job.
Social Hour.
Banquet and Dance.

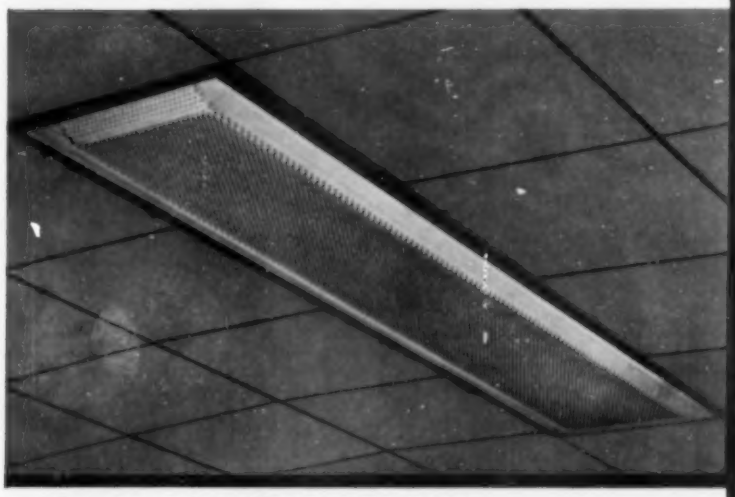
Saturday Morning — June 11

Presiding — R. O. Mills, Chairman
Connecticut Section, and
N. E. Tiechurst
New England Section, and
John W. Hamilton
New York Section

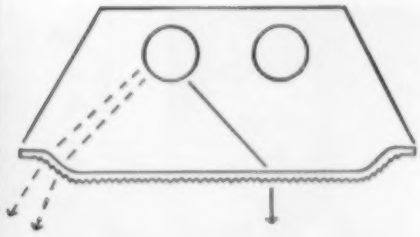
A Modern Concept in Vision and Seeing — Dr. Lester H. Sugarman, American Optometric Association.

(Continued on page 14A)

ARCHITECT'S AND ENGINEER'S FACT SHEET



Corning uses pyramidal and linear prisms to get maximum light control in this interesting new low-brightness lens panel.



Pyramidal prisms in the center portion concentrate light from the tubes and reflector so that it leaves the fixture at angles below the glare zone. The linear prisms have a uniform down-bending action controlling the light which might otherwise escape at higher angles from the slanted sides.

ANNOUNCING...

Corning's New Low-Brightness Curved Lens Panel

Corning has put two kinds of prisms and a curve in one new panel to give you a new combination of beauty and utility in your lighting design.

Pyramidal prisms in the panel's center section concentrate light from the tubes and reflector at angles below the glare zone. Linear side prisms have a uniform down-bending action on light that might otherwise escape at higher angles. You get a high coefficient of utilization.

Away with monotony

With the new Corning Curved Lens Panel, the architectural boredom of "flat" ceilings with recessed troffers is no more. Lighted or unlighted, the curved contour and the prism pattern lend new interest to ceilings and fixtures.

You can get this *new* lightweight Corning panel in lengths up to 48", with open or closed ends. They're easy to maintain, will never discolor or sag.

To get complete information on Corning's Low-Brightness Curved Lens Panel, simply mail the coupon. Or, contact your Corning lightingware representative.

Information on Corning Low Brightness Lens Panel

LENGTH: Code 541371—47¾" both ends closed.
Code 541372—12", 24", 36" or 48" both ends open.
Code 541373—11⅞", 23⅞", 35⅞", 47⅞" one end closed.

LENGTH TOLERANCE: ±1/16".
On 541372 only +0 −⅛".

WIDTH: 10⅝" ±1/16". DEPTH: 2 7/32".

THICKNESS: .180".

WEIGHT: 2.0 lbs. per running foot.

SUGGESTED SPECIFICATIONS

The lens panel for the fluorescent fixtures shall be a continuous curved lens made of colorless crystal glass. It shall be of the low brightness type, with configuration of six-sided pyramids in the center section, with linear down-bending prisms in the side areas.

Dimensions and suggested specifications.

AVERAGE BRIGHTNESS (Ft.-L)

Angle	2480 Lumens Across Axis	2480 Lumens Along Axis	2560 Lumens Across Axis	2560 Lumens Along Axis
85°	302	233	312	240
80°	320	252	330	260
75°	295	313	304	323
70°	300	412	310	425
65°	315	532	325	549
60°	375	607	387	626
55°	504	723	520	746
50°	682	841	704	868
45°	885	967	913	998
40°	1047	1077	1081	1112
35°	1137	1142	1174	1179
30°	1155	1182	1192	1220

CORNING GLASS WORKS
CORNING, N. Y.

Corning means research in Glass

CORNING GLASS WORKS, 69-8 Crystal Street, Corning, N. Y.
Please send me information on Corning's New Low-Brightness Curved Lens Panel.

Name..... Title.....

Company.....

Address.....

City..... Zone..... State.....

New Fellows

C. L. Amick

Louis E. Barbrow

Arthur C. Barr

B. S. Benson, Jr.

Albert H. Clarke

C. L. Cottrell

Charles D. Gibson

C. A. B. Halvorson

C. Carter Lewis

W. A. Pennow

Mary E. Webber

Charles E. Weitz

(Continued from page 12A)

A Study in Street Lighting Reflector Design—William B. Elmer, Wheeler Reflector Co.

Higher Distribution Voltages for Commercial Buildings—Richard H. Schneider, Westinghouse Electric Corp.

Committee

Those specifically responsible for this successful meeting were:

C. E. Waldron ..... Conference Chairman
Duncan M. Jones ..... I.E.S. President
C. W. McCormick .... Regional Vice-President
Louis Goren .... Chairman, New York Section
E. J. Perkins .. Chairman, New England Sec.
R. O. Mills ..... Chairman, Connecticut Section
H. H. Friedman .. Chairman, East. N. Y. Chap.

Committee Chairmen

Banquet ..... H. A. Collman
Budget and Finance ..... H. H. Friedman
Papers and Program ..... C. D. Hollister
Publicity ..... R. H. Rice and E. K. Rice
Registration ..... H. J. Fitzpatrick
Hotel ..... L. N. Lamboy
Property ..... E. F. Eaton
Entertainment ..... R. A. White
Ladies' Committee ..... Mrs. Lee Bass
Transportation ..... J. F. Delaney
Local Activities ..... A. E. Peabody
Lighting and Decoration ..... D. E. Voorhies

Twelve I.E.S. Members Elected to Fellow Grade

Twelve distinguished members of the I.E.S. were elected to the grade of Fellow, by action of the Society's Council and Council Executive Committee, on recommendation of the Board of Fellows.

Charles L. Amick, Fluorescent Lamp and Auxiliary Equipment Coordinator, Application Engineering Department, General Electric Co., Lamp Division, Cleveland. Mr. Amick is, perhaps, best known for his book *Fluorescent Lighting Manual*, published by McGraw-Hill Book Company in 1942 and 1947 (third edition now being prepared). This has been widely used as a reference text by architects, engineers, students, contractors and many others and was one of the first extensive compilations of information on fluorescent lamps. The book has been translated into Spanish and is published in Buenos Aires by Arbo Editores.

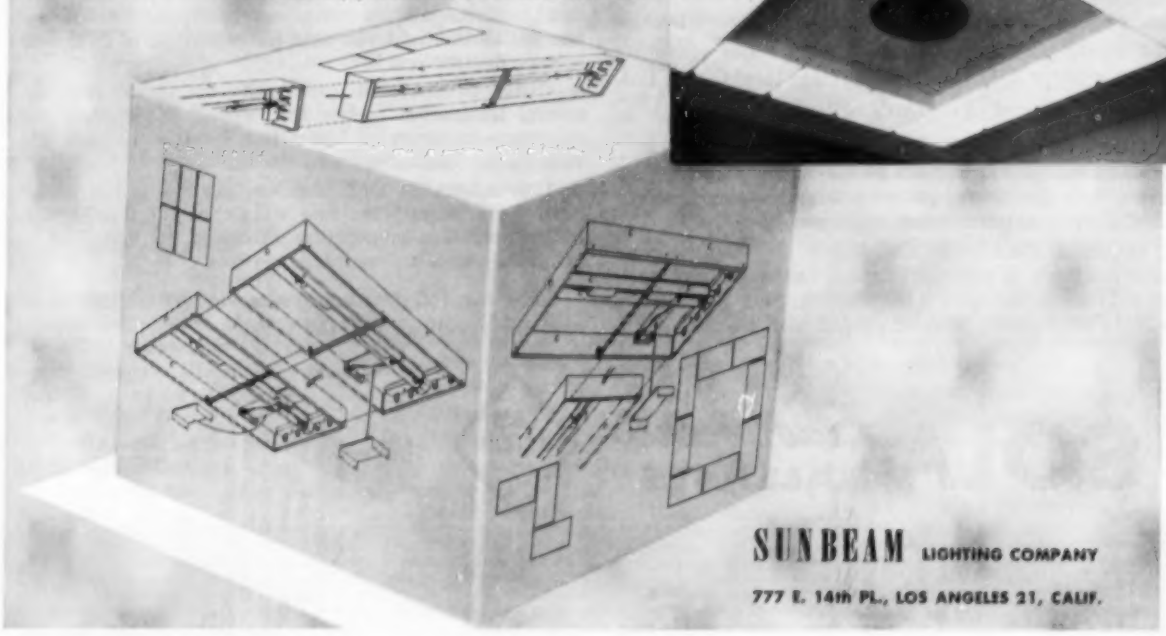
In 1941, with R. L. Oetting, Mr. Amick stimulated a more active appreciation of the influence which fluorescent lamps had on the appearance of colored materials. In 1947, after much experience in computing utilization data from luminaire photometric data, he called attention to the need for further tests on utilization of concentrated direct lighting equipment. Later, with A. C. Barr, he proposed a uniform method for calculating initial, operating and overall costs of lighting systems for impartially com-

(Continued on page 17A)

NEW LUMINOUS BLOCKS FOR LOW BUDGET LIGHTING

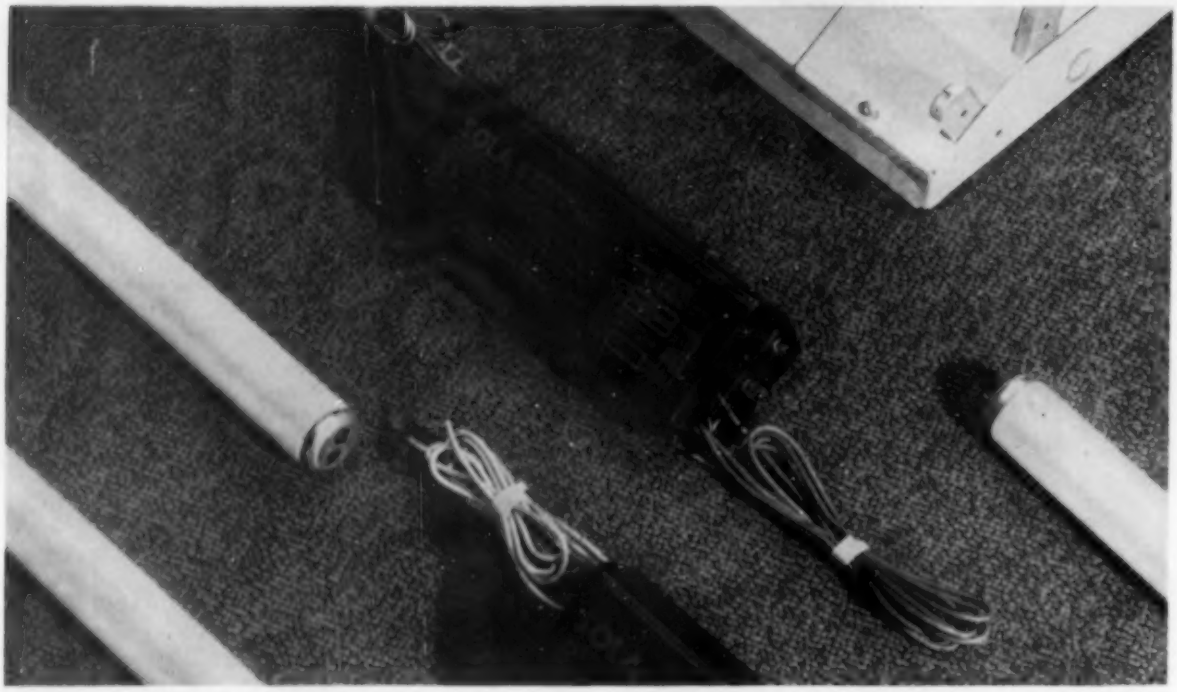
visionaire

A new degree of design freedom and lighting flexibility at lower initial cost is now at your command with Sunbeam's new Visionaires,® 7700 series. Almost as simple as putting blocks together, these all-white, surface mounted luminaires can be arranged in modern geometrical patterns and "large area" arrays with amazing ease. Solidly welded, the 7700 series is constructed in exact modules of 2′ wide by 4′, 6′ and 8′ long to readily match standard acoustical ceiling patterns. The rigidized diffuser panels are molded of translucent white vinyl producing pleasant, low brightness lighting. For complete information on Sunbeam's 7700 series, please write for bulletin A59.



SUNBEAM LIGHTING COMPANY

777 E. 14th PL., LOS ANGELES 21, CALIF.



PREMIUM PERFORMANCE FOR RAPID-START SYSTEMS: When Sola Constant Wattage Ballasts are part of your 40w rapid-start fluorescent lighting team, the result is longer lamp life, reliable starting, constant light output, quiet operation and long ballast life. The low, compact ballast for two 40w rapid-start lamps fits all standard fixture channels.

Sola Ballasts Provide Constant Wattage for 40-watt Rapid Start Systems at Ordinary Ballast Cost

Do you manufacture fixtures? Do you specify or install lighting equipment? If so, your 40w rapid-start fluorescent lighting system can now include the operating superiorities of Sola Constant Wattage Rapid-Start Ballasts — at the cost of ordinary ballasts.

1. LONGER LAMP LIFE: Lamp life is inversely proportional to the peak/rms ratio of the lamp's current wave shape. Sola Ballasts' peak/rms ratio is approximately 1.5 @ 118v — extremely low with good wave shape.

2. RELIABLE STARTING: The higher the voltage from lamp electrode to grounded fixture (an important starting aid) the more positive the starting. Sola 40w ballasts provide 300v across lamp-to-ground with perfect safety.

3. CONSTANT LIGHT OUTPUT: Lumen output held constant to within ±2% over a primary range of 106-130v — you get all the light you paid for regardless of 20% line voltage fluctuations.

4. QUIET OPERATION: Progressive compound pouring, special lamination design and pressed-in core-and-coil construction minimize lamination hum — ballasts are suitable for quiet-area installations.

5. LONG BALLAST LIFE: Temperature rise is low under normal operation. When one or both lamps fail or rectify, ballast operating temperature is reduced, not increased — result is low ballast maintenance cost.

Write for full information or request a Sola sales engineer to call with all the facts.

SOLA *Fluorescent* **BALLASTS**

CBM CERTIFIED by ETL

REQUEST BULLETIN 3H-FL-199

CONSTANT VOLTAGE TRANSFORMERS for Regulation of Electronic and Electrical Equipment • **LIGHTING TRANSFORMERS** for All Types of Fluorescent and Mercury Vapor Lamps. • **SOLA ELECTRIC CO.,** 4633 West 16th Street, Chicago 50, Illinois, Bishop 2-1414 • *NEW YORK 35: 103 E. 125th St., TRafalgar 6-6464* • *PHILADELPHIA: Commercial Trust Bldg., Rittenhouse 6-4988* • *BOSTON: 272 Centre Street, Newton 58, Mass., Bigelow 4-3354* • *CLEVELAND 15: 1836 Euclid Ave., Prospect 1-6400* • *KANSAS CITY 2, MO.: 406 W. 34th St., Jefferson 4382* • *LOS ANGELES 23: 3130 E. Olympic Blvd., ANgelus 9-9431* • *TORONTO 9, ONTARIO: 617 Runnymede Rd., Lyndhurst 1454* • *Representatives in Other Principal Cities*

(Continued from page 14A)

paring the economy of proposed installations.

Mr. Amick has presented several papers before I.E.S. National Conferences, and has served on numerous technical committees. As Chairman of the Committee on Lighting Design Practice, he supervised the revision of the Calculations Section in the Second Edition of the *I.E.S. Lighting Handbook*.

In addition he has served the Society in many non-technical capacities in both the Cleveland Section and on a national level. He is currently a member of the National Technical Conference Committee.

Louis E. Barbrow, Chief, Photometry and Colorimetry Section, National Bureau of Standards, Washington, D. C. Mr. Barbrow has specialized, with constructive and significant results, in the area of organization and coordination of activities. He has recently coordinated in an interlaboratory comparison of fluorescent lamps involving seven laboratories and three types of lamps. He is a contributing author of many papers published in the National Bureau of Standards' Journal of Research, for over twenty years.

Mr. Barbrow served as Chairman of the Capital Section of I.E.S. in 1947-1948, and has been member of many of the Society's committees, notably the Committees on Nomenclature, Light Sources and Standards of Quality and Quantity for Interior Illumination, and was Vice-Chairman of the Papers Committee in 1953-1954.

In the international field, Mr. Barbrow is an Official Representative, United States National Committee of the International Commission on Illumination, and a member of the Executive Committee and Statutes Committee of the C.I.E. He is also a member of the Advisory Committee on Electrical Accessories of the United States National Committee of the International Electro-Technical Commission.

Arthur C. Barr, Manager of Consumers Lamp Sales, Illuminating Engineer, General Electric Co., Lamp Division, Cleveland. Mr. Barr has presented several papers before National Technical Conferences of the Society, reporting original work. He has served as member and Vice-Chairman of the Progress Committee and the Lighting Maintenance Committee, and as member of the Committee on Testing Procedures for Illumination Characteristics and the Subcommittee on Color Rendition of the Committee on Light Sources.

Benjamin S. Benson, Jr., Chief Illuminating Engineer, Illuminating Engineering Department, Benjamin Electric Manufacturing Co., Des Plaines, Ill. Mr. Benson's contributions to the field of illuminating engineering include the development of a unique integrating sphere of low-cost design making it possible for many more laboratories to have this equipment in their photometric sections. Another development was that of coefficients of utilization for luminous ceilings, putting illumination design for luminous ceilings on an engineering basis.

The list of technical committees on which Mr. Benson has been a member is extensive, and among them the Committees on Illumination Performance Recommendations, on Light Control and Equipment Design, on Lighting Design Practice and on Sports and Recreational Area Lighting perhaps stand out. He has published many papers in ILLUMINATING ENGINEERING.

Albert Howe Clarke, Vice-President, Illumination, Crouse-Hinds Co. Mr. Clarke was a pioneer in many early applications of sports lighting. In 1929, as part of the 50th Anniversary of Edison's invention of the incandescent lamp, two of the first football stadium lighting installations were made under his design and supervision, the Rose Bowl and the Syracuse University Stadium. He was also a pioneer in the development of lighting for airports and airways being involved in the design and application of these types of specialized lighting equipment since the inception of airport lighting. He has traveled over all of North America and in parts of Europe as consultant to government agencies concerned with aviation lighting.

Mr. Clarke was in personal charge of the design of specialized lighting equipment for measurement of cloud heights and atmospheric transmission for the United States Weather Bureau. During World War II he worked closely with the U. S. Navy in the development of infrared signalling equipment for intership communication.

A member of the Aviation Lighting Committee from 1936 to the present time and of the Sports and Recreational Area Lighting Committee from 1946, Mr. Clarke has also served on other of the Society's technical committees.

He has been and is a member of several of the technical committees of the United States National Committee of the International Commission on Illumination. He is the author of many magazine articles on subjects of floodlighting and airport lighting.

Casper L. Cottrell, Professor, Electrical Engineering, Cornell University. Under the sponsorship of the I.E.S. Research Fund, Dr. Cottrell developed the Contrast Brightness Threshold Meter which is widely used in measuring visibility. He has been instrumental in many developments in brightness and its measurement, optics, fatigue and vision and in color. He was associated for a time with the National Bureau of Standards and with the Munsell Color Company working on photometry and in research on color. He has served on various of the technical committees of I.E.S., such as Color and Illumination, Handbook Revision, Nomenclature, Papers, and Hotel Lighting.

In the Central New York Section, he has held practically every position, as Secretary Treasurer, Chairman, Board of Managers, Board of Examiners, and on Section Committees.

Charles D. Gibson, Supervising Field Representative, California State Department of Education, School Planning, Los Angeles, Calif. School lighting is Dr. Gibson's field, and in it his contributions are many. His work as an I.E.S. member with the National Council of Schoolhouse Construction and the American Institute of Architects has been invaluable for long range conditioning of classroom visual environment. His persistent efforts are always directed to the fact that visual environment in classrooms should never be compromised but should be progressively improved. He has served as Vice-President and President of the National Council for Schoolhouse Construction and prepared the section on "Conditioning Schoolrooms for Visual Comfort and Efficiency" for the Guide for Planning School Plants published by the NCSC in 1946, 1948, 1952.

His published papers have appeared in numerous journals for architects, school planners and administrators, and in ILLUMINATING ENGINEERING. As a member of the Painting and Color Committee of the California Association of School Business in the years 1941 to 1953, he prepared and established Painting and Color Standards for school classrooms in the State of California.

Dr. Gibson has served the Society on the School Lighting Committee and the Daylighting Committee and was Chairman of the Southern California Section in 1945-1946.

C. A. B. Halvorson, Jr., Lighting Consultant, East Lynn, Mass. The more than 100 patents, for sodium, mercury and incandescent luminaires, held by Mr.

Halvorson attest to his many contributions to illuminating engineering. One of the nation's leaders in the outdoor illumination field and a charter member of the I.E.S. Street and Highway Lighting Committee, he has been instrumental in the design, development and application of equipment to improve the street and highway lighting throughout the country. His patents also embrace the fields of traffic signals and control features, motion picture projection equipment and lighting glassware. He is also responsible for many developments in airport lighting, sports lighting and floodlighting.

Upon his retirement from the General Electric Company in 1945, Mr. Halvorson was elected a Member Emeritus of I.E.S., which he had joined in 1912. He is currently serving as Chairman of the Subcommittee on Standard Practice of the Street and Highway Lighting Committee.

C. Carter Lewis, Chief Illumination Engineer and Commercial Sales Manager, Union Electric Co. of Missouri. Mr. Lewis has devoted his work in illumination to the application of materials, equipment and developments of others to the benefit, application and use in the users' residence, industry and place of business, and the teaching to others of his knowledge.

Among his original works has been the pioneering of the use of overvoltage on lamps to gain additional light at low cost, as in football fields and sports arena, by the use of transformer taps. He pioneered also in advocating the benefits of high levels with high quality lighting installations to merchandisers in the Midwest. He is recognized in the whole area for his crusading vigor to educators and school administrators for high quality lighting in schools.

In 1929 he planned the extensive St. Louis celebration honoring Thomas Edison in "Light's Golden Jubilee." He has planned and scheduled readings on the subject of illumination in such organizations as the Engineer's Club of St. Louis and the St. Louis Electrical Board of Trade. He has lectured widely on illumination and its relationship and importance to other professions.

Mr. Lewis is a charter member of the St. Louis Section, and was its chairman during its first year. He was a Director and member of Council of I.E.S. in 1946-1947 and served an interim appointment as Midwestern Regional Vice-President during 1954.

Willis A. Pennow, Manager, Aviation and Marine Lighting Section, Engineering Department, Westinghouse Electric Corp. Mr. Pennow's work has resulted in many new methods now adopted as standard in the fields of theater projection, marine and navy searchlights and airport lighting. He was the originator of the low intensity carbon arc in 1927 for moving picture projection, and he has invented and developed several new types of airport runway lights including the present standard U. S. Air Force unit. He also originated the optical system now standard in all marine searchlights and the differential arc control system standard on navy searchlights. One of his more recent significant original contributions is the krypton condenser discharge light for All Weather Airport Approach systems. This light and the associated equipment developed by Mr. Pennow to achieve 90 times the brightness of the sun has been installed at the Cleveland, New York Idlewild, and Arcata, Calif. Airports. Shortly after its development, modified systems of this equipment were installed by the U. S. Air Force at Berlin and seven other European airports where it became one of the major factors contributing to the success of the Berlin Airlift.

A research on paint and color specifications for the aviation ground lighting equipment instigated and supervised by Mr. Pennow has resulted in standards of quality and colors now used by all government agencies and manufacturers.

Mr. Pennow is a member of the I.E.S. Aviation Lighting Committee and of many of its subcommittees. He is the author of numerous papers and technical articles.

Mary E. Webber, Home Lighting Specialist, General Electric Co., Lamp Division. From the time that Miss Webber first joined the Society, she has been active in Committee work, particularly in the residential lighting field. It was during the period when she was Chairman of the Residence Lighting Committee that the current "Recommended Practice for Residence Lighting" was prepared and published.

Practically all of Miss Webber's published work and lectures are based on her own experimental work on various aspects of home lighting. An example is her development of techniques for lighting the home study center. Another is the comprehensive work she did on brightness limitations of home lighting equipment, which has become an important part of modern residence lighting practice. More recently she has been developing lighting practice for outdoor family activities and has contributed much original thought to the design of such luminaires and their location.

Her published papers, mainly on residence lighting, have appeared in ILLUMINATING ENGINEERING and other publications.

Charles E. Weitz, Engineer, Lamp Division, General Electric Co. During his career with engineering publications on lamps and lighting, Mr. Weitz has done much to provide handbooks, bulletins and other technical publications for others to learn about illuminating engineering. He has contributed technical information which has widely influenced the advancement of the science. Many colleges and universities, in their electrical engineering and architectural schools, use his material to supplement their courses of study in lighting. He is the author of the lighting lesson booklets published by the International Correspondence School which have a wide distribution throughout the United States. He has contributed material for use in the Lighting Section of the New Encyclopedia Britannica; and lighting texts for the International Textbook Company.

Mr. Weitz has been a member or chairman of various I.E.S. Committees: Lighting Education, Progress, Publicity, Publications, Sustaining Membership; and of the subcommittee on Brightness Conditions of Educational Environments. He has served the Cleveland Section as Chairman, Secretary, and member of the Board of Managers. He was the I.E.S. representative in the editing of the Illumination Section of the Ohio State Building Code, in 1950-1951.

Certified Lighting Contest Announced by R. I. Electric League

The Certified Lighting Bureau of the Electric League of Rhode Island opened the second year of its activity August 1, with a $500 prize contest for electrical contractors.

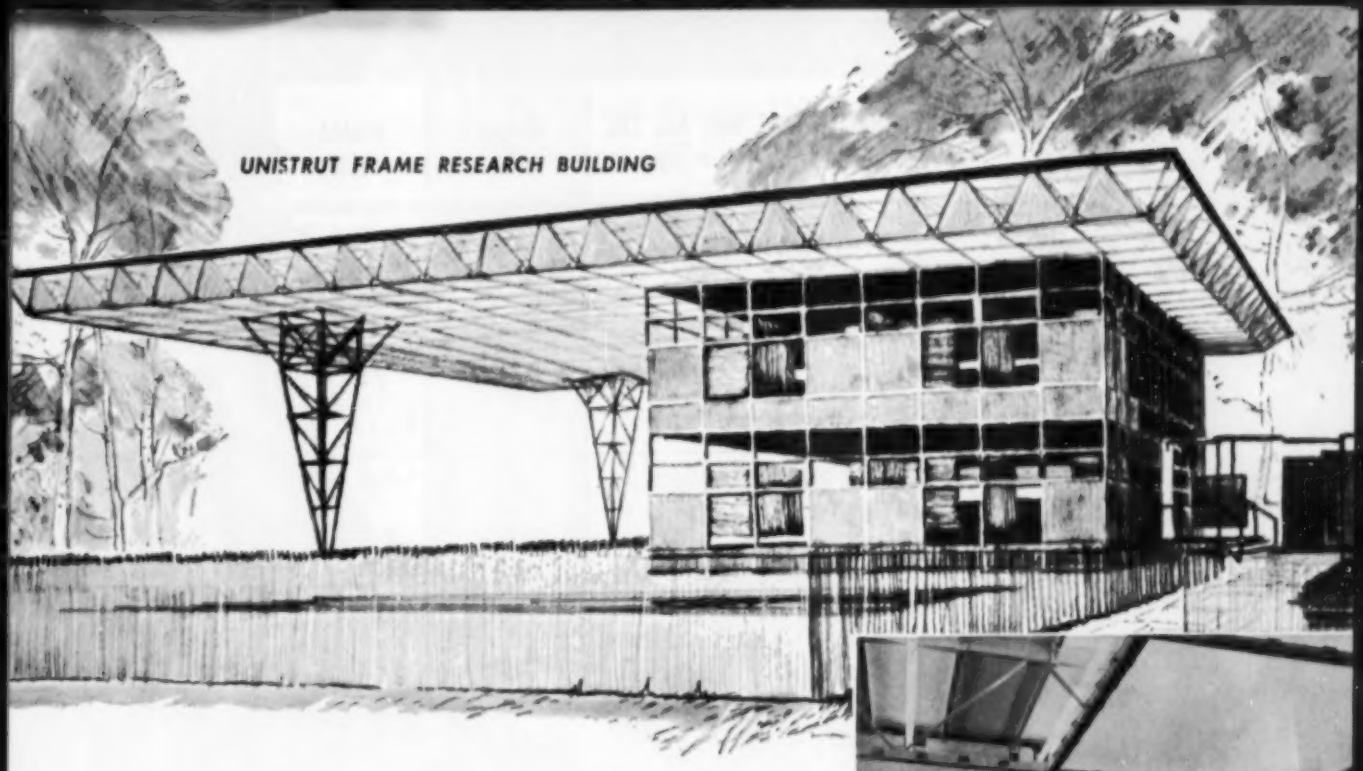
The contest runs for six months—from August 1, 1955 to January 31, 1956. Only lighting plans submitted during this period will be eligible and all jobs must be completed by January 31, 1956.

Basis of the Certified Lighting Contest will be a point system:

For each Certified Plan submitted — 10 points
For each Certified Installation — 50 points
For each 10,000 lumens installed — 5 points
For each calculated footcandle above CLB Handbook minimum — 5 points
For each "plus" feature installed — 5 points

Prizes will be: First, $200; second, $100; third, $50; fourth, $40; fifth, $30; sixth, $25; seventh, $20; eighth, $15; ninth to twelfth, $5.

(*Continued on page* 21A)



CEILING IN SPACE FRAME STRUCTURE FEATURES TRANSLUCENT PANELS OF EXTRUDED LUCITE®

Two-story research laboratory at Ann Arbor embodies new concept in design

A STUDENT in the College of Architecture and Design installing a 4' x 4' translucent panel of "Lucite" acrylic resin. The experimental laboratory consists of an enclosed area, 33 by 49 feet beneath a 70- by 90-foot roof. The drafting area on the lower level of the enclosed area uses a ceiling of Du Pont "Lucite" acrylic resin for transmitting optimum light without glare.

"Durable, flexible, expandable, demountable and reusable." That's one professor's description of the new research laboratory at the University of Michigan. The Unistrut Space Frame System introduces a third dimension of reinforcement—diagonal struts to distribute stress in three directions. As a result, supporting columns are needed only at widely spaced intervals and interior walls carry none of the roof load.

The walls, ceiling, and roof utilize many 4' x 4' translucent and transparent panels. For example, on the lower level under the north mezzanine the ceiling is constructed of Du Pont "Lucite" acrylic resin. These lightweight modular units of "Lucite" were extruded by Gering Products, Inc., of Kenilworth, New Jersey. They transmit all wave lengths of visible light, are glare-free. Panels of "Lucite" are exceptionally strong and can withstand direct and prolonged exposure to sunlight and weathering without discoloring or crazing.

"Lucite" permits unusual decorative effects. It comes in a wide variety of transparent and translucent colors. Extruded "Lucite" acrylic resin can be fabricated into troffer-type panels and corrugated shapes to meet any custom design specifications.

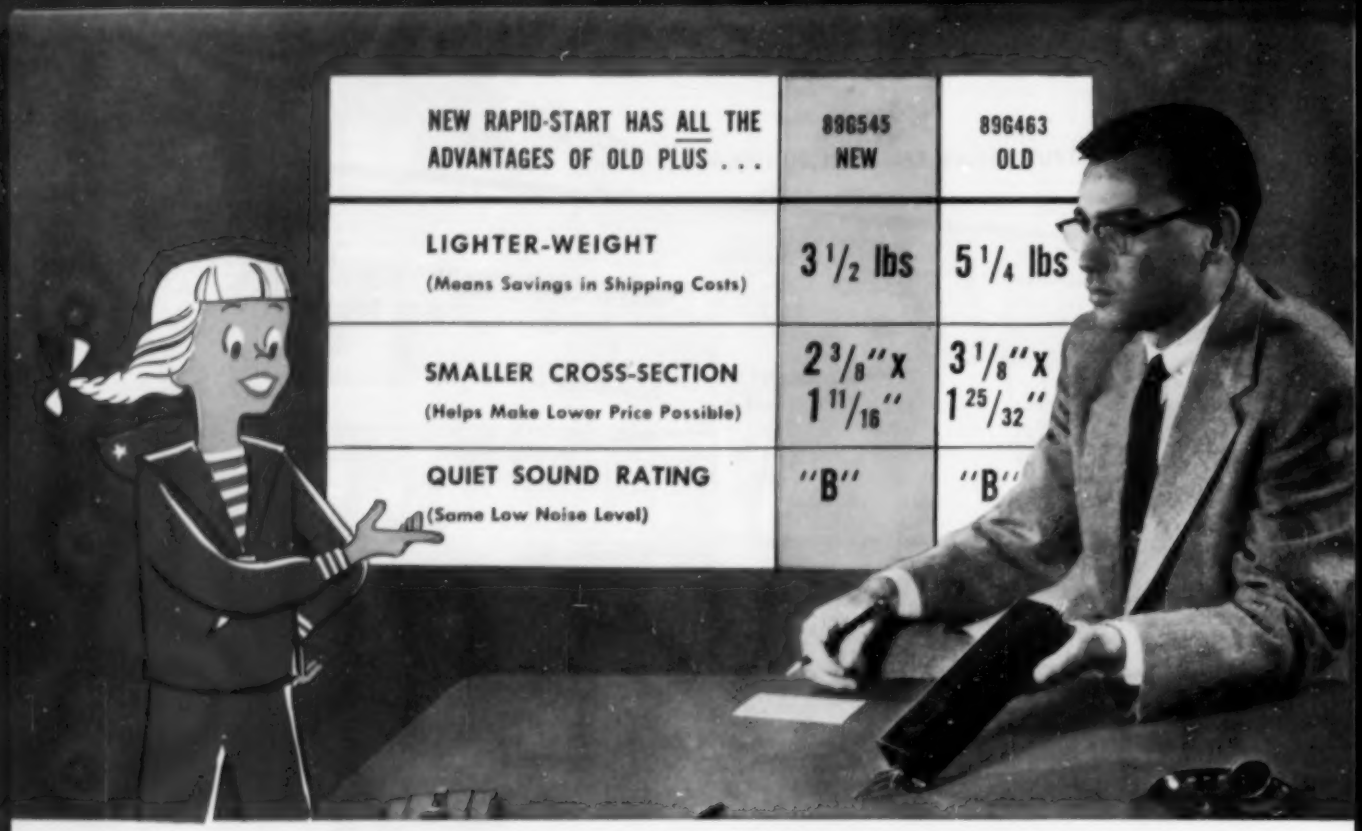
For further information on "Lucite" acrylic resin—its properties and uses as a lighting material—write to E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Department, Room 288, Du Pont Building, Wilmington 98, Delaware. In Canada: Du Pont Company of Canada Limited, P. O. Box 660, Montreal, Quebec.

Good Lighting Is Good Business

DU PONT

REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*



FLORA EXPLAINS how the new G-E rapid-start ballast has a smaller brickette cross section while it still retains the same short length of the old brick ballast. There is no increase in heat rise and the new ballast has the same quiet sound rating of "B."

Flora shows you why . . .*

NEW G-E Ballast is 28% Smaller, 33% Lighter; Helps You Save Lighting Dollars

General Electric's ballast design leadership program has produced a new CBM-certified rapid-start ballast that is lighter, smaller, and costs less. G-E ballast engineers, through an ingenious redesign of the core and coil structure, have cut the weight down 33 percent and the cross section dimension by 28 percent. In addition, the new 40-watt rapid-start G-E ballast is easier to connect (it has an extra green lead); substantially reduced in price.

This is progress you can measure; progress that is the result of the intensive and continuing program of ballast design and development engineering. And these new developments will soon be applied to other G-E ballasts.

Next time you specify equipment for a fluorescent lighting installation make sure you get the best . . . specify General Electric ballasts. Look for the G-E ballast tag. For further information on G-E ballasts, write Section 401-17, General Electric Company, Schenectady 5, New York

*Miss Fluorescent Ballast, G.E.'s Ballast Mascot.

Copyright 1955, General Electric Company

G-E DEVELOPMENT engineer testing the new rapid-start ballast design that does the same ballasting job for less money.

Six reasons why

GENERAL ELECTRIC IS YOUR BEST BALLAST VALUE

- EXCLUSIVE SOUND RATING SYSTEM
- PROVED PRODUCT LEADERSHIP
- SUPERIOR QUALITY CONTROL
- LONGER BALLAST LIFE
- PRECISE LAMP-MATCHED DESIGN
- COMPLETE CUSTOMER SERVICES

Progress Is Our Most Important Product

GENERAL ELECTRIC

(Continued from page 18A)

The contest is being administered by the Executive Committee of the Certified Lighting Bureau, consisting of W. I. Colson (Chairman), C. R. Broadhead, Paul Manchester, W. W. Botts, Jr., R. H. Waterman, A. V. Bartlett, Jr., W. M. Freudigman.

Comments Invited on C.I.E. Tentative Recommendations

Recommendations tentatively approved at the Zurich Congress of C.I.E. will become effective six months after their tentative approval unless objection is entered by any National Committee. Anyone desiring to comment on or object to any of the proposed Recommendations should communicate with Mr. L. E. Barbrow, Secretary of the U. S. National Committee, C.I.E., National Bureau of Standards, Washington 25, D. C. The limiting date for comments or objections is October 1, 1955. A limited number of complete sets of tentatively approved Recommendations are also available from Mr. Barbrow, as are a complete list of the papers and secretariat reports presented at Zurich, and preprints of these documents, at a nominal price.

Puget Sound Section Takes to TV

Good lighting in the living areas of the home and the importance of good lighting for human eyes was the theme of a 30-minute television program presented, June 16, by the Puget Sound Section on Station KING. Dr. Howard Hall, optometrist and active I.E.S. member, emceed the show, assisted by Marshall Perrow, architect.

Thirteenth Plenary Meeting of C.I.E. Held in Zurich, Switzerland

Dr. Ward Harrison of the United States completed his four-year term as President of the Commission Internationale de l'Eclairage (International Commission on Illumination) when he presided over the 13th Session of the Commission, held in Zurich, Switzerland, June 13-22, 1955. More than 500 delegates from 27 countries, including 36 delegates from the U.S.A. attended the Sessions. New officers as follows were elected to serve for the four-year period ending in 1959, when the 14th Session of the Commission will be held in Belgium:

J. W. T. Walsh (Gt. Britain)	President
A. A. Brainerd (U.S.A.)	Vice-President
R. Deaglio (Italy)	Vice-President
L. Fink (Austria)	Vice-President
M. Jacob (Belgium)	Vice-President
W. W. E. Von Hemert (Netherlands)	Treasurer
Y. LeGrand (France)	Secretary

Dr. Harrison, as retiring President of the C.I.E. presided at the Sessions, and made a principal address. Addresses of Welcome were made by Dr. Roeser, head of the Swiss Engineering Society, and Dr. E. Landolt, President of the City of Zurich.

Parallel Sessions were held by the 35 Technical Committees of the Commission. Each of these Committees presented a technical report for discussion. In addition, 34 papers were presented at the Sessions. Prominent among these papers were six of U. S. origin:

Visual Research in the United States, by C. L. Crouch, Technical Director of the Illuminating Engineering Society.

Ward Harrison, President of C.I.E.

Recent Studies of Visual Discrimination, by H. R. Blackwell, University of Michigan.

Fundamentals of Museum Lighting, by Laurence S. Harrison.

Physiological Bases of Disability Glare, by Glenn A. Fry.

Electri al Measurement of Fluorescent Lamps, by E. H. Salter, R. G. Slauer and Arthur Weeks.

Subjective Additivity of Sources of Brightness, by S. K. Guth.

Seven of the Technical Committee Reports were compiled by United States Secretariat Directors, as follows:

Airport Lighting and Signals — W. C. Fisher.
Color of Signal Lights — F. C. Breckenridge.
Predetermination of Illumination and Luminance — W. M. Potter.
Popular Education — S. G. Hibben.
Colorimetry — D. B. Judd.

(Continued on page 23A)

S. G. Hibben and Mrs. Hibben at the banquet. Mr. Hibben, an I.E.S. Past-President, is Director for the Secretariat on Popular Education, presenting its report at the June 15 sessions.

H. H. Magdsick, United States Representative on the International Scope Committee of C.I.E.; with Mrs. Willard Brown; Willard Brown (G-E) is at far right, and in the background are the Al Clarks (Crouse-Hinds).

Set the Scene with

LITECONTROL

for Readin' is easy on the eyes in this schoolroom with the even, high level lighting of Litecontrol Fixture 6628. Note the unusually good end-throw, the smart simplicity. It's 86% efficient, simple to install and maintain.

Restin' takes a load off the eyes, too, in this modern air terminal. Three Litecontrol fixtures make it exceptionally light, yet never bright. Slim 3224 guides traffic in corridors. Counters smile cooperatively with square incandescent lens boxes. While the waiting-room relaxes in the light touches of round, wide-angle lens boxes.

Ritin' is never a strain when the light's *right* — free from shadows and glare. Litecontrol's *Luminous Ceiling* incorporating Holophane low-brightness lenses provides it here with beauty, efficiency, economy.

'n 'Rithmetic. Litecontrol Fixture 5138 pays off in dollars and sense, as it puts these products in their *best* light. Holophane low-brightness lens prevents unflattering glare. Hinged door frames open or close *at the snap of your fingers,* on exclusive Litecontrol *Trigger Catch* snap-locks.

There's a LITECONTROL Fixture for every scene and situation. You, too, can have "custom" beauty and performance at "standard" prices. Write for catalog and complete information.

LITECONTROL

Fixtures

LITECONTROL CORPORATION

36 PLEASANT STREET, WATERTOWN 72, MASSACHUSETTS

Lighting for Photography, Cinema and Television Production — A. H. Kliegl.
Operating Accessories — E. H. Salter.

An interesting innovation at the Sessions this year was the use of simultaneous translation; the three official languages were English, French and German.

Most of the administration concluded their terms in office, at this congress, including Dr. Harrison, President, and C. A. Atherton, Honorary Secretary. Both these men were given ovations in the closing Plenary Session. Mr. Atherton, who had served two four-year terms, had developed a proposed plan of more vigorous pursuit of international progress and accord by recommending a series of small working committees composed of experts who should study together during the interim periods and develop international reports of agreement on those subjects most needful of resolution. This was adopted and working committees were decided for the following with country sponsorship as shown.

Colorimetry (United States)
Color Rendering (Germany)
Color of Signal Lights (Great Britain)
Visual Performance (United States)
Sources of UV and IR Measurement (Germany)
Predetermination of Illumination and Luminance (France)
Causes of Discomfort in Lighting (Australia)
Pleasantness in Lighting (Netherlands)
Daylight (Australia)
Street Lighting (Great Britain)
Aviation Ground Lighting (Netherlands)
Airborne Lighting and Signals (United States)
Automobile Headlights and Signal Lights (Netherlands)
Signal Lights (France)

Most of the other subjects continue under the Secretariat form of reporting progress at the regular Plenary Sessions.

In general the delegates were preoccupied with technical activities which precluded partaking of many of the diversions which Zurich and the surrounding area of Switzerland could offer.

C. A. Atherton, Honorary Secretary.

(Continued on page 24A)

Ray P. Teele, National Bureau of Standards; Mrs. Teele; C. A. B. Halvorson, newly elected Fellow of I.E.S.; and Professor Dan Finch, University of California.

C. L. Crouch, I.E.S. Technical Director; N. A. Halbertsma from the Netherlands; and M. Cohu, Editor of the French publication, *Lux*.

Mrs. S. English; H. L. Logan (Holophane Co., New York) and Mrs. G. Campbell, Jr.

Dr. S. English, head of the British delegation; Charles Franck (Holophane Co., New York); and Mrs. J. R. Holmes.

International group at the C.I.E. meeting in Zurich.

However, many of the delegates did participate in several features arranged by the host committee. These included a boat ride on Lake of Zurich to Rapperswil; inspection of indoor and outdoor installations; a visit to Oskar Reinhart Foundation in Winterthur; banquet at the Congress House; and an excursion to Bern.

On Sunday, June 18, the delegates were treated to a trip to Burgenstock via Lucerne. From this spot over 2000 feet above lake level, reached by funicular, there was a commanding view of the surrounding mountains and waters. The more hardy delegates availed themselves of the opportunity to climb still higher and to culminate their climb by using the Hammetschwand lift for the last 550 feet up the side of that mountain to its peak.

The results of the work transacted at the Technical Sessions will be published in a three-volume Proceedings which will be available early in 1956.

Attendance Breakdown At 13th C.I.E. Congress

Delegates from 27 nations attended the Zurich meeting of C.I.E. A breakdown by classification of interest in lighting yields the following. Registrants from the host nation of Switzerland are not included in the numbers given.

From Government Laboratories and Departments	87
From Universities	45
Architects, consulting engineers, representatives of consumer industries	22
From Government-owned electric power and gas supply	55
Secretaries of technical societies, press representatives and private participants	26
TOTAL — not connected with the lighting industry	235
Research personnel of manufacturers in the lighting industry	58
Other lighting industry representatives	174
TOTAL — with lighting industry connections	232

Old Searchlight Revamped To Create Artificial Moonlight

The old 60-inch searchlight of World War II has been adapted for a new role according to the Illumination Section of the Corps of Engineers' Research and Development Laboratories, Fort Belvoir, Va.

Supplanted by radar for aircraft detection, it has been transformed into a self-contained mobile unit to supply battlefield illumination or "artificial moonlight" for combat operations.

Originally designed for transport in two trailers towed by a pair of 2½-ton trucks, the entire unit has been mounted on a single truck of the same size. The old method of transporting the unit was adequate for anti-aircraft units emplaced in rear areas, sometimes at the same location for days.

Mounting the entire unit on one truck, however, became necessary to permit the rapid and frequent movement required for frontline battlefield illumination.

The new truck is equipped with sides which can be let down to form a platform for the operator. The engine generator set which powers the unit is mounted directly behind the cab of the truck. Army units achieved much success in Korea by locating the searchlights five to ten thousand yards behind the area they wanted illuminated and directing the beams at a low elevation.

Light, scattered from the beams, provided illumination equivalent to an almost full moon over an area 800 yards wide and 1500 yards long. Greater width but less illumination was obtained when they defocused the beam. Since it is directional and can be controlled, the light gives our combat troops a considerable advantage over the enemy.

N.I.C.O. and C.C.O. Merge To Form New College

A merger of the Northern Illinois College of Optometry and Chicago College has been announced. The new institution has been chartered as the Illinois College of Optometry by the State of Illinois, according to Dr. Glenn H. Moore, chairman of the new board of trustees. Dr. Eugene W. Strawn, of Freeport, Ill., is the new president. Dr. Strawn was formerly chairman of the board of C.C.O., while Dr. Moore was chairman of the N.I.C.O. board. Dr. Richard Feinberg, former president of Illinois College of Optometry is vice-president and dean of the new organization. Dr. Morton L. Abram, former president of C.C.O. is vice-president and business administrator.

ABOUT PEOPLE

Pittsburgh Reflector Co. announces the establishment of a new division for the production of two new items, ceiling and church lighting. **Eric D. Altree** has been named to head this newly established division. **Harold D. Siler** succeeds Mr. Altree as Manager of the Engineering department of the company.

Gene G. Rae has been promoted by the Board of Directors of the Holophane Company, Inc., to Vice-President, Controlens Division. Mr. Rae was previously manager of the division.

Charles H. Goddard has been elected a vice-president of Thomas A. Edison Inc., West Orange, N. J. Mr. Goddard

(*Continued on page 26A*)

Main control room, Receiving Station G, Department of Water and Power of the City of Los Angeles. White translucent diffusers are fire-retardant PLEXIGLAS 5009. Panels measure 2' by 4', are dimple-patterned.

Where the task is exacting——

use PLEXIGLAS diffusers

This control room requires lighting of the highest quality, because the seeing tasks involved in the constant reading of instruments and keeping of records are complex and exacting.

Diffusing panels of PLEXIGLAS® acrylic plastic are an important part of the carefully engineered lighting system that produces the desired results. Light is spread evenly across the entire surface of each diffuser. The illumination level is high; surface brightness, and brightness ratios throughout the room, are low. There is a notable absence of shadows and reflected glare.

In addition to its superiority in the diffusion and transmission of light, PLEXIGLAS is rigid, strong and durable. It has exceptional freedom from discoloration on long exposure to fluorescent lamps. Lighting systems incorporating PLEXIGLAS retain their efficiency and new appearance for many years.

We will be glad to send you details about the installation shown above.

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East Central Regional Conference

These photographs, taken at the East Central Regional Conference, May 19 and 20 in Reading, Pa., were received after the July issue of I.E., with the report on the Conference, was on the press.

East Central Regional V-P C. J. Berry presents the checks and awards to the winners of the Region's My Most Interesting Lighting Job Contest. Left to right: Mr. Berry; H. M. White, Maryland Section, first prize; Josef Tama, Pittsburgh Section, second prize; H. T. Weidman, Eastern Pennsylvania Section, third prize; and G. W. Wagner, Philadelphia Section, honorable mention.

On the opening day of the East Central Regional Conference: left to right, Paul H. Hildebrand, Past Regional V-P; Duncan M. Jones, I.E.S. President; P. A. Kinsey, Chairman of the host Eastern Pennsylvania Section, and Regional Vice-President C. J. Berry.

will continue as assistant manager of the company's Voicewriter division. Also named a vice-president is **Dr. Donald W. Collier**, director of research.

Election of **Robert W. Minett, Jr.**, as president of the American Home Lighting Institute, Chicago, has been announced. Mr. Minett is vice-president in charge of merchandising for Thomas Industries, Inc.

Ted Jorgensen has been appointed the New York representative for the Kirlin Company, Detroit. The Ted Jorgensen Company is located at 101 Park Ave., New York City.

A. R. Nelson, general superintendent of distribution, Electrical Department, Public Service Electric and Gas Co., Newark, has been named a Fellow of the American Institute of Electrical Engineers.

Appointment of **James H. McDuffie** as manager of employee and plant community relations for the General Electric Co.'s Outdoor Lighting Department has been announced. The appointment was effective August 1. Mr. McDuffie's headquarters will be at Hendersonville, N. C., where a new plant is being built as the future home of the Outdoor Lighting Department. **Fred J. Reynolds** has been named manager of employee and plant community relations for the company's Ballast Department, in Danville, Ill. Mr. Reynolds was formerly the director of industrial relations for U. S. Industries, Inc.

Westinghouse Electric Corp., Lamp Division, has announced four recent appointments — a regional operations manager and three assistants to regional managers. **John F. Kelleher** has been named regional operations manager for the Eastern and New England Regions of the Lamp Division with headquarters in New York City and Belmont, Mass. **Wayne D. Baker, Gordon W. Butler** and **Willard C. Hird** have been appointed assistants to the managers of the Southeastern, Southwestern and Pacific Coast Regions, respectively. Headquarters for the three men will be in Chamblee, Ga.; St. Louis, Mo. and Emeryville, Calif.

Jay G. Gates has been appointed Southern Sales Manager for the Transformer Division of Kuhlman Electric Co., with headquarters at the company's factory in Crystal Springs, Miss.

Mitch Bobrick has been named by Marvin Manufacturing Co., to be in

(Continued on page 34A)

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PLANT CITY, U.S.A.=

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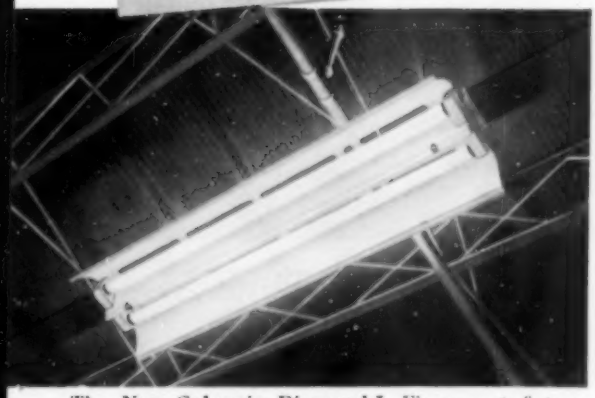
REPRESENTATIVE WILL CALL WITH FULL DETAILS=

T. G HEARN, SALES MANAGER - FIXTURES
SYLVANIA ELECTRIC PRODUCTS INC., WHEELING, W. VA.=

THE COMPANY WILL APPRECIATE SUGGESTIONS FROM ITS PATRONS CONCERNING ITS SERVICE



The New Sylvania Diamond-I. Fluorescent fixture features one-man maintenance. Has only 2 major components—lightweight, 4-foot reflector-shield assembly on all units, and one-piece channel assembly.

Perhaps you personally received this telegram which was sent to many of our customers. Because the response was so tremendous, we knew we had something big, new, exciting—a lighting fixture that will set the standard in industry for years to come. If you did not receive the telegram, we reproduce the message here as an invitation for you to learn more about the Diamond-I. Send the coupon below for complete information, or to have a Sylvania lighting specialist call with full details.

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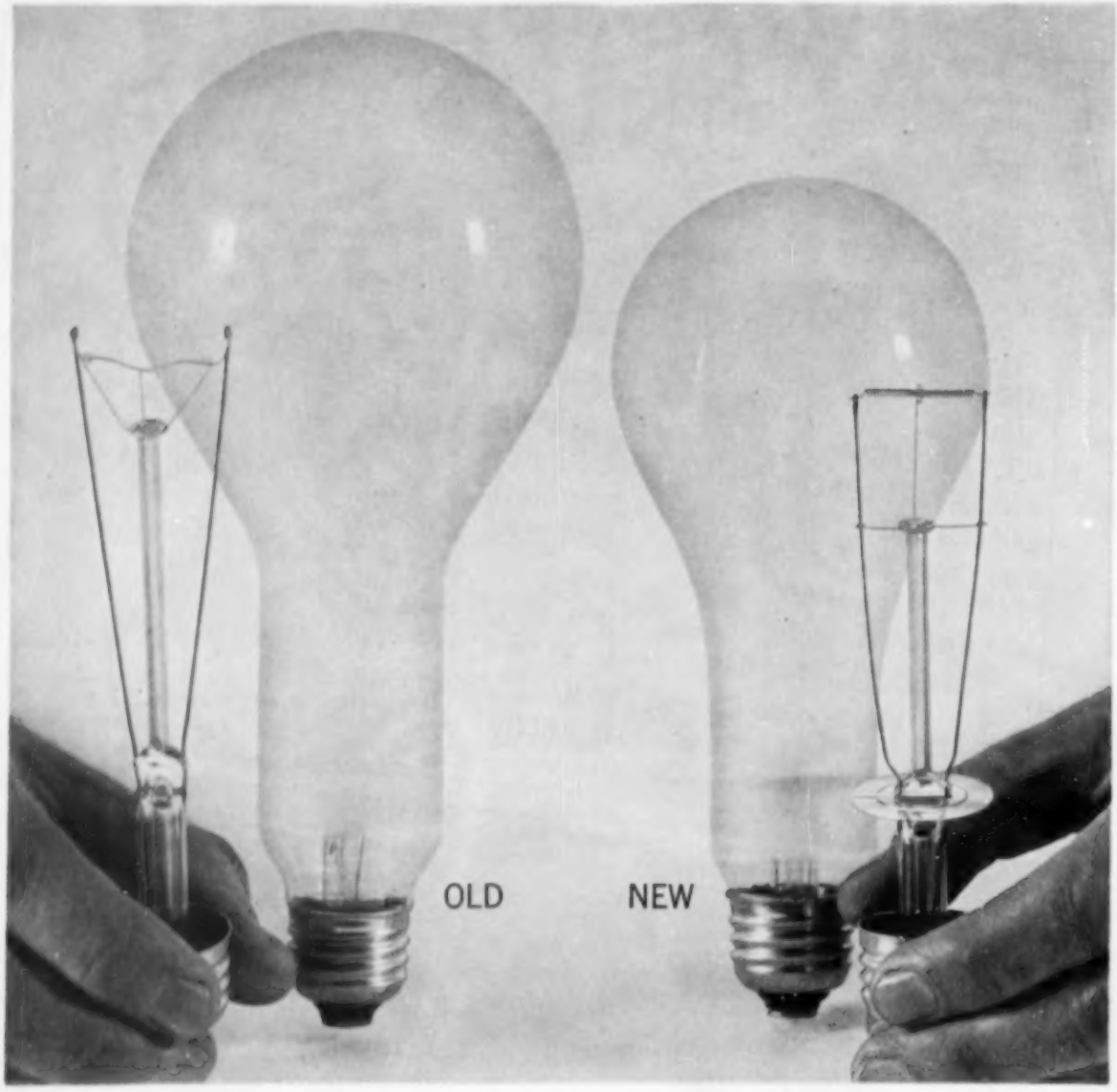
G-E LAMPS GIVE YOU MORE FOR ALL YOUR LIGHTING DOLLARS



New General Electric 200-watt bulb takes less space, but gives more light

A NEW General Electric 200-watt bulb, shorter and slimmer than the old one, fits into fixtures and lamps that would formerly take nothing larger than a 150-watt bulb.

The new G-E bulb gives about 3% more light than the old one. In the new bulb, the filament is an efficient *coiled* coil, which needs only one support. The filament of the old bulb is a single coil which needs three fine-wire supports. Although these support the filament firmly, they tend to cool it and slightly reduce the light. Based on average operating costs, the extra light of the new bulb is worth 7¢ to 10¢ over the life of the bulb.

Though the new design puts the hot filament closer to the base, the new General Electric 200-watt bulb is safe to use even in paper-lined sockets. That's because of a heat-reflecting disc of aluminum between the base and the filament.

With all this extra value built in, the new bulbs list at a penny *less* than the old. For more facts on how General Electric gives you more for *all* your lighting dollars, write for a 16-page G-E progress report to lamp users. It's free, just write General Electric Company, Dept. 482-IE-8, Nela Park, Cleveland 12, Ohio.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Day-Brite Plexoline® with accent lighting, Section of Main Floor Sales Area, Roger's, Inc., Fitchburg, Mass.

The path to greater sales— Day-Brite flexible *Plexoline*

Poor store lighting is a roadblock that slows down sales. Store owners realize this and do something about it—they are clearing the path to sales with the Day-Brite *flexible* Plexoline store-lighting system.

By offering an unusual degree of placement flexibility, Plexoline opens up new avenues of lighting that accelerate store traffic—and sales. With these versatile lighting units you can establish graceful curves of light, circular contours, angular patterns. In fact, they can be adapted to almost any counter and display layout, particularly when combined with Day-Brite accent units.

SEE, EXAMINE and COMPARE Day-Brite with any other lighting system. Look at the fixtures—not just the pictures!

CALL YOUR DAY-BRITE REPRESENTATIVE. He's widely experienced in store lighting and can help you clear a path to greater sales.

5507

Day-Brite Lighting, Inc., 5432 Bulwer Ave., St. Louis 7, Missouri

"DECIDEDLY BETTER" DAY-BRITE Lighting Fixtures

NATION'S LARGEST MANUFACTURER OF COMMERCIAL AND INDUSTRIAL LIGHTING EQUIPMENT

Accidents reduced...costs cut...with HAPCO Aluminum Standards

When Hapco Standards are installed, there's real reason for civic pride. Not only do they last longer, they look better longer because their silver gray surface is resistant to virtually all atmospheric conditions. Furthermore they require no maintenance so that the investment in Hapco Aluminum Standards guarantees minimum overall lighting cost. For proof that "Aluminum costs less," write the Hapco Engineering Department.

What's more, their high visibility helps reduce accidents.

Hapco Aluminum Poles are sturdy enough for the heaviest duty, yet they maintain harmonious beauty with their surroundings. All Hapco Standards are Venetian column type, acclaimed by architects for eye appeal and strength. For street lighting, for traffic control lighting, for area flood lighting, these Hapco Aluminum Alloy Standards allow you the widest possible choice in fine lighting equipment.

Be sure to call your Hubbard representative for assistance in specifying lighting standards, traffic signal pedestals, flood lighting standards, and related equipment. You can order Hapco products through more than 200 leading electrical distributors throughout the United States.

FREE HAPCO Catalog

If you'd like more details on design features and specifications of the complete Hapco line, write for this new free catalog. It contains valuable information to help you plan the most efficient, most beautiful highway and street lighting, as well as any other outdoor lighting requirement. (Hubbard Aluminum Products Company, 6301 Butler Street, Pittsburgh 1, Pa.)

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Division of Hubbard & Company
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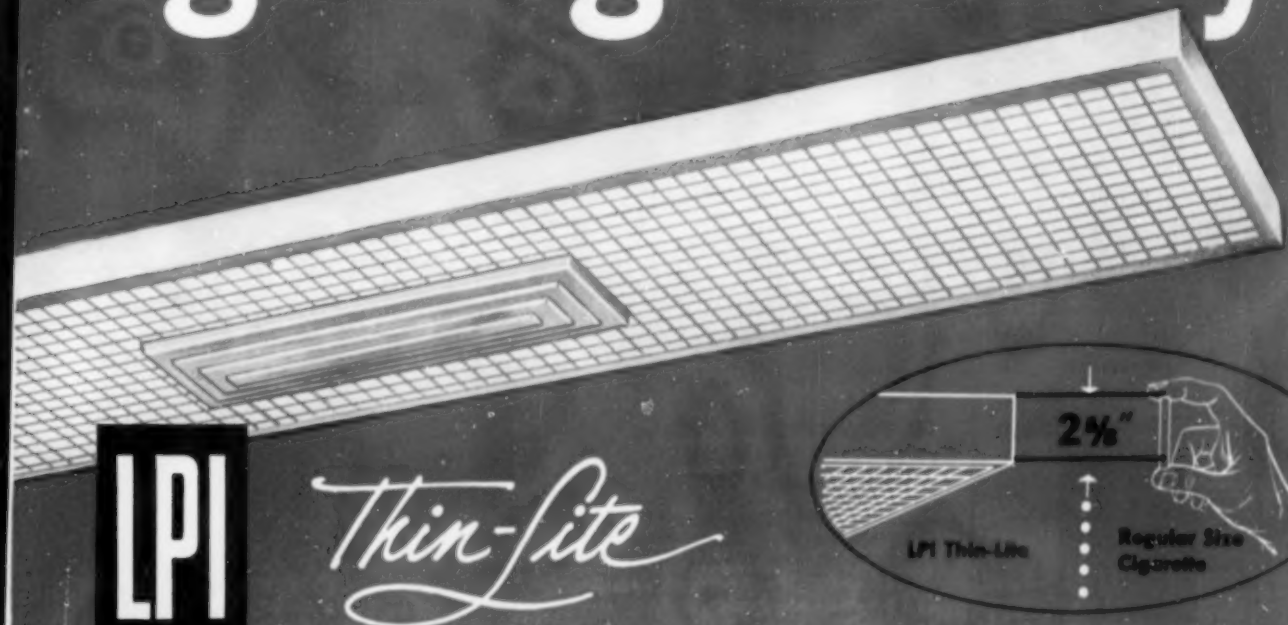
It's making

lighting history!



LPI *Thin-Lite*

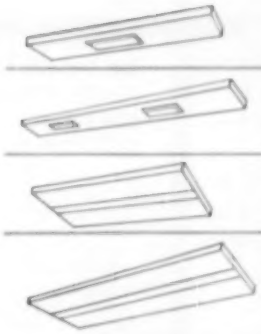
World's Thinnest Shielded Luminaire

No wonder Thin-Lite is creating such a sensation from coast to coast. Here, at last, is a surface mounted fixture so shallow that its depth below ceiling is essentially the same as that of troffers fitted with dished shields. Thin-Lite actually creates a semi-recessed effect.

The four different models (right) can be mounted end to end or side by side, in any combination, to form an unlimited variety of lighting patterns up to any desired size. A few suggestions are shown below.

Thin-Lite luminaires feature metal-framed, molded plastic louver panels, secured by LPI's patented floating hinge which cannot be seen from any angle, and which eliminates unsightly latches and fastening devices.

Available through leading electrical wholesalers, Thin-Lite luminaires are wired with standard E.T.L. ballasts.



THR 240—49" long, 12¼" wide, 2⅝" thin. Two 48" Rapid Start lamps.

THS 296—97" long, 12¼" wide, 2⅝" thin. Two 96" 430 MA. lamps.

THR 440—49" long, 26¾" wide, 2⅝" thin. Four 48" Rapid Start lamps.

THS 496—97" long, 26¾" wide, 2⅝" thin. Four 96" 430 MA. lamps.

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MORE LUMENS PER DOLLAR

THAN EVER BEFORE FROM A LUMINOUS INDIRECT FIXTURE!

ALL-METAL
Luminous steel-slat fin design is unique! No plastic to warp or discolor!
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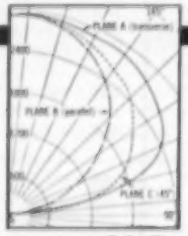
PATENTED LUMINOUS INDIRECT TRIUMPH

37% MORE LIGHT

Think of it!—an 86.5% efficiency is achieved by the LEADLIGHTER! Resulting from the first successful use of 800MA components in an indirect design, this amounts to 37% more light than could be obtained from 430MA components!



EFFICIENCY: 86.5%

Brightness Range: 0.1 to 0.4 candles per sq. in.

Distribution: Luminous indirect, upward component 96.5%, downward component 3.5%.

THE ONE-AND-ONLY ALL METAL FULLY VENTILATED LUMINOUS INDIRECT DESIGN IN HISTORY!

High efficiency in a luminous indirect fixture is now an accomplished fact! All the advantages of indirect lighting are now combined with the most desirable aspects of direct illumination in this remarkable LEADLIGHT luminaire. From this light source of surpassing beauty you can now derive the comfortable, glareless and shadowless light of widespread upward distribution, together with the high utilization previously obtained only from direct fixtures!

The ingenious parallel steel-slat open fin design permits circulation of cooling air, prevents settling of dust and debris, achieves a pleasant degree of luminosity, **yet completely shields all lamps.**

THE ONE-AND-ONLY INDIRECT FIXTURE UTILIZING 800MA LAMPS AND BALLASTS, YET RETAINING IDEAL LOW BRIGHTNESS!

The use of 800MA lamps contributes a tremendous increase in light output **without proportionate increase in cost!** This added lumen value permits very high levels, yet the indirect LEADLIGHTER design maintains controlled low brightness. Internal reflector surfaces are contrived for exceptionally wide distribution, resulting in increased lumens per dollar. Indirect shielding is effected entirely with the use of high-reflectance enamelled steel! Construction is strong and durable; installation is simple and quick.

WRITE FOR THE FULL STORY, SPECIFICATIONS AND COMPLETE LEADLIGHT CATALOG

LEADLIGHT FIXTURE COMPANY

800 - 100TH AVE., OAKLAND, CALIF.

See Page 34A for important notice to all IES members whether or not you can attend the 1955 National Technical Conference at Cleveland

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1948 Advance originates compact, light-weight Lead-Lag slimline lamp ballast design.

1950 Improved Series — Sequence slimline lamp ballast design created by Advance engineers.

1950 Advance Series — Sequence design becomes standard for the lighting industry.

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Preprints of all papers to be presented at the I.E.S. National Technical Conference, Cleveland, Ohio, September 12-16, 1955

SAVE TIME AND BOTHER

Important to registrants and all members of I.E.S. are the preprints of the technical papers to be presented at the coming National Technical Conference . . . printed and ready for the opening sessions. These papers present all that is new in theory and techniques of lighting and are an invaluable reference source. Even if you can't attend the Conference, the preprints will give you a detailed panoramic view of new developments in the lighting field. Papers are assembled in sets and will be available at the Conference Registration Desk when you "check in," for use at the sessions and for future reference.

To expedite delivery of the 1955 I.E.S. National Technical Conference preprints to both those who will attend and to those who for some reason cannot be present, the attached order form is provided. Please indicate whether you will pick up your papers **AT** the Conference or wish them **MAILED** to you at the time of the Conference.

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Price per set . . . $2. If to be mailed, add 50c for postage. Just fill in form, attach check or money order and mail to I.E.S. Publications Office, 1860 Broadway, New York 23, N. Y.; or include with registration fee check.

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charge of a new design and development program in the field of incandescent lighting. Mr. Bobrick has previously done lighting design work with Sunbeam Lighting, General Lighting and with Marvin Manufacturing.

I.E.S. Sections report with sorrow the deaths of the following members:

Emory L. Puckett, Florida Section.

Eugene M. Stein, Consolidated Edison Co. of New York, New York Section.

IT SEEMS TO ME

I.E.S. Local Activity

It seems to me that our Society is becoming stronger and mightier because of continued activity in local operations. There is nothing more important than local meetings and almost daily there is evidence that these are reaching a new high in interest throughout the country. Such meetings are responsible for our ever increasing membership. Sustaining Members are aware of these local inspirational meetings and realize that their contributions are being used for a good cause in lighting research problems. Moreover, local meetings are the momentum behind our successful and well-attended Regional Conferences. Indeed, they are the backbone of our National Conferences (why not come to Cleveland in September and see for yourself).

Just the other day we received a letter from Brooks Chassaing, Chairman of the St. Louis Section, 1954-1955. The sentiments expressed apply to many of our Chairmen of Sections and Chapters. The letter is quoted in part as follows:

> We thought you might be interested in knowing that for eight regular monthly business meetings of our Section, our average attendance was 116 persons. These figures do not include the attendance at our Annual Spring Dinner Dance, which was held in May. Also, you might be interested in knowing that while we apparently will not win first prize in the Membership Increase Campaign for our group, yet we did show quite a healthy increase in members through the years and you can rest assured that this has been brought about through the subjects presented before our groups.

Congratulations, Brooks, to you and your grand working team of officers and committeemen. GEORGE J. TAYLOR, *I.E.S. Treasurer, 1954-1955.*

NEW MEMBERS

At the meeting of the I.E.S. Council Executive Committee held in New York, N. Y., on July 7, 1955, the following were elected to membership. Names marked * are transfers from Associate Member grade.

ALABAMA CHAPTER

Associate Member:
Wheeler, B. M., Jr., Westinghouse Electric Corp., Birmingham, Ala.

ALAMO CHAPTER

Member:
Greeman, Nelson, Jr., 201 Majestic Bldg., San Antonio, Texas.

ARK-LA-TEX CHAPTER

Associate Member:
Ingersoll, W. I., Interstate Electric Co. of Shreveport, Inc., Texarkana, Ark.

BRITISH COLUMBIA SECTION

Associate Members:
Bullock, J. B., C. B. U. T., Vancouver, B .C.
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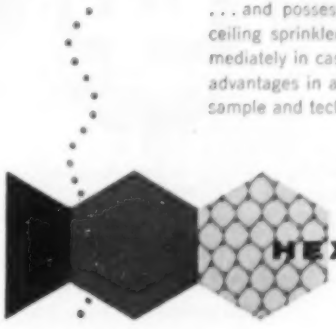

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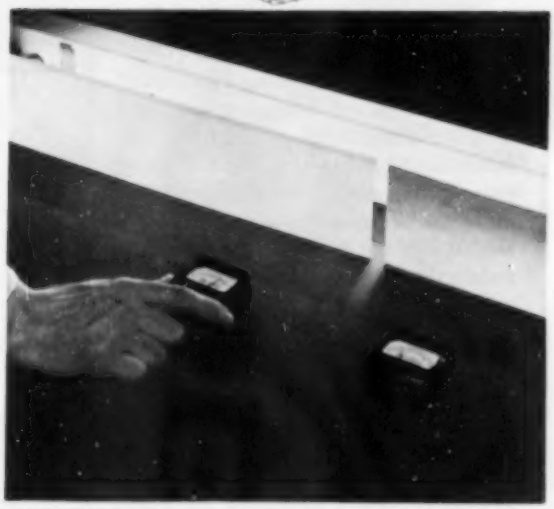

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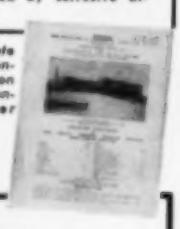

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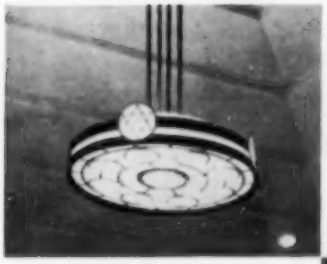

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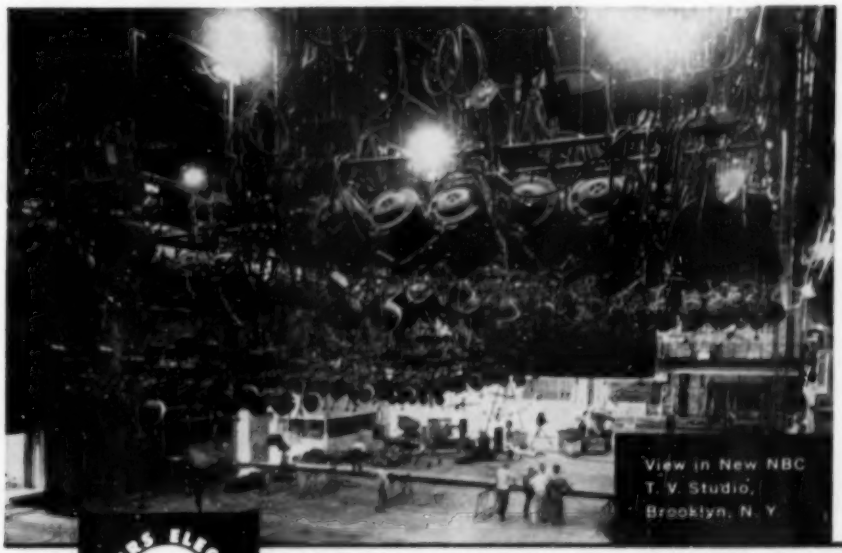

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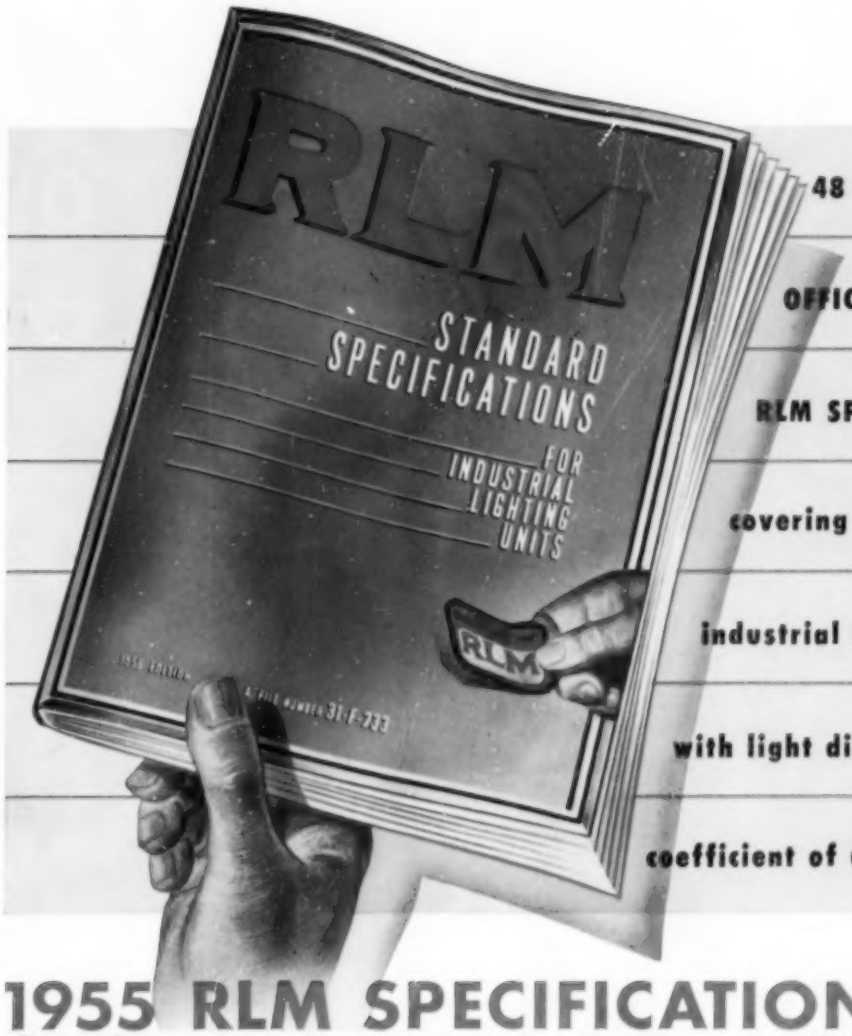

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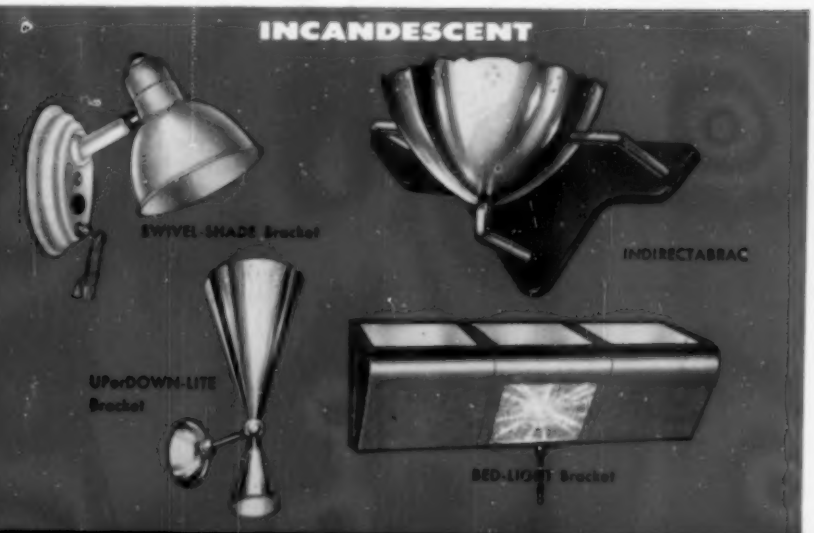

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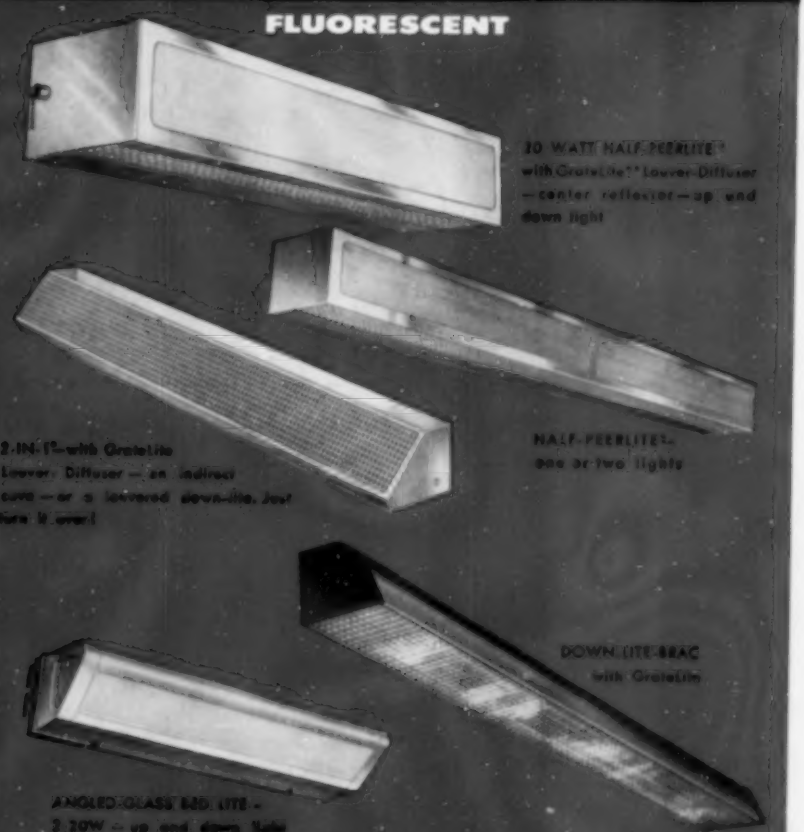

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